THE AEROPLANE and ASTRONAUTICS

JULY 22, 1960

EVERY FRIDAY
ONE SHILLING
AND SIXPENCE

'ENGLISH ELECTRIC'

THUNDERBIRD

The only ground-to-air
Guided Missile system available for
both static and mobile use.

ENGLISH ELECTRIC AVIATION LTD
GUIDED WEAPONS DIVISION, LUTON · STEVENAGE · WOOMERA

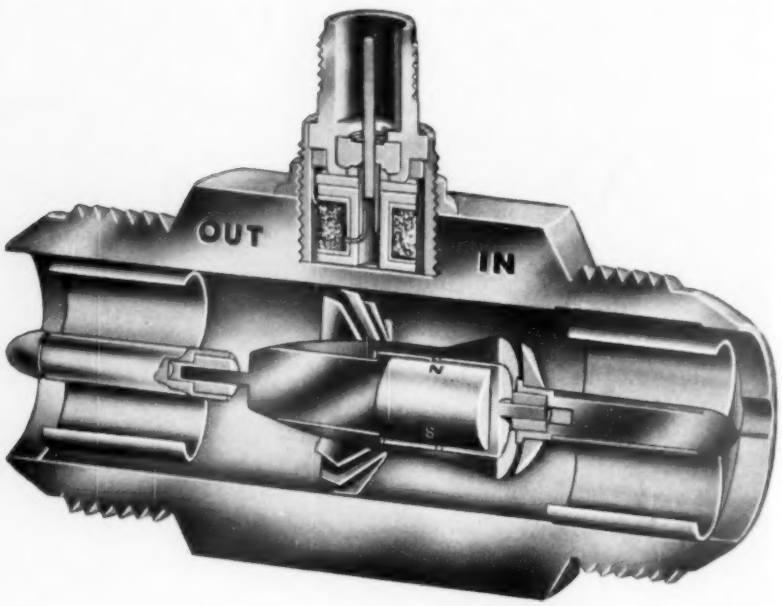
MEMBER COMPANY OF BRITISH AIRCRAFT CORPORATION

GW.27

Wherever information on fluid flow is required,

the de Havilland POTTERMETER

sets new standards of accuracy and reliability



This new turbine-type flowmeter enables major advances to be made in the techniques of flow measurement and control. The de Havilland Pottermeter is the only flowmeter which offers all these features:

Accuracy to ± 0·1% or better on repetition work, ± 0·5% or better over a 20·1 range. Calibration remains constant for a variety of liquids over wide flow ranges.

Accurately records mass flow.

Contains only one moving part — no thrust bearings — demands a minimum of maintenance.

No larger than the pipeline in which it is installed — may be mounted in any attitude.

Can be supplied with indicating, recording and process control equipment — gives digital presentation of results.

Models available to measure flows from 0·1 to 40,000 Imperial gallons per minute, at a wide range of operating pressures. Larger and smaller sizes made to order.

Can measure flow of any liquid or gas, irrespective of its lubricating or non-lubricating properties, at temperatures ranging from -455°F to 1500°F.

Manufactured as standard in stainless steel — can be made in any non-magnetic material.

Rapid response rate permits transient flow studies.

Write now for further details to:

DE HAVILLAND PROPELLERS LIMITED

(INDUSTRIAL SALES DIVISION) Hatfield, Herts.

Second class postage paid at New York, N.Y.

Douglas will have a hand in world-wide television

Soon the horizon will no longer limit the reach of live television. A series of reflecting satellites will give you a front row seat at events televised from anywhere on earth.

These communications satellites are to be launched by Douglas *Thor* missiles. Foil-covered, they will balloon out in orbit and serve as inexpensive relay stations.

Douglas is proud to be playing a major role in the space age. *Thor*, with more than 50 successful flights, has become the workhorse of U. S. space research.

Advanced engineering, high performance, reliability and economy of operation have always been hallmarks of Douglas products whether the medium is space or air.

Tomorrow or today . . . in space projects or air transportation, you can depend on Douglas.

Foil-covered satellite, folded like a pocket raincoat, would balloon out in orbit as an inexpensive TV relay station

DOUGLAS

BUILDERS OF THE DC-8 JETLINER

MISSILE AND SPACE SYSTEMS • MILITARY AIRCRAFT • TRANSPORT AIRCRAFT • AIRCOMB® • GROUND SUPPORT EQUIPMENT

A

THIS COPTER DELIVERS A 2,000-POUND PAYLOAD AT 14,000 FEET!

The turbine-powered Sikorsky S-62 can hover . . . and then deliver, with pin-point precision, a 2,000-pound payload up where it counts—at 14,000 feet. This is an unprecedented performance, better even than is possible with much larger helicopters and far in excess of anything possible with helicopters of the S-62's weight class. This opens up new horizons for high altitude exploration, construction and supply—important news for helicopter operators.

And altitude capabilities are only one of the many unique features built into this boat-hulled turbocopter. It takes off and lands almost anywhere—land, water, shipboard, marsh, ice, mud. Cable or write for complete operating facts, including the new gains in economy possible with the S-62.

Sikorsky S-62 demonstrates 2,000-pound payload delivery in the Himalayas at 14,000-foot altitude.

UNITED AIRCRAFT EXPORT CORPORATION

East Hartford 8, Connecticut, U.S.A.

HAMILTON STANDARD · SIKORSKY · NORDEN · CANADIAN

European Headquarters: 3/5 Warwick House Street, London S.W. 1, England

AT LONDON AIRPORT

EAGLE

OFFER

★ Component overhauls

★ Maintenance

★ Modifications

★ Aircraft catering

★ Design facilities

★ Technical and traffic handling

★ Conversions

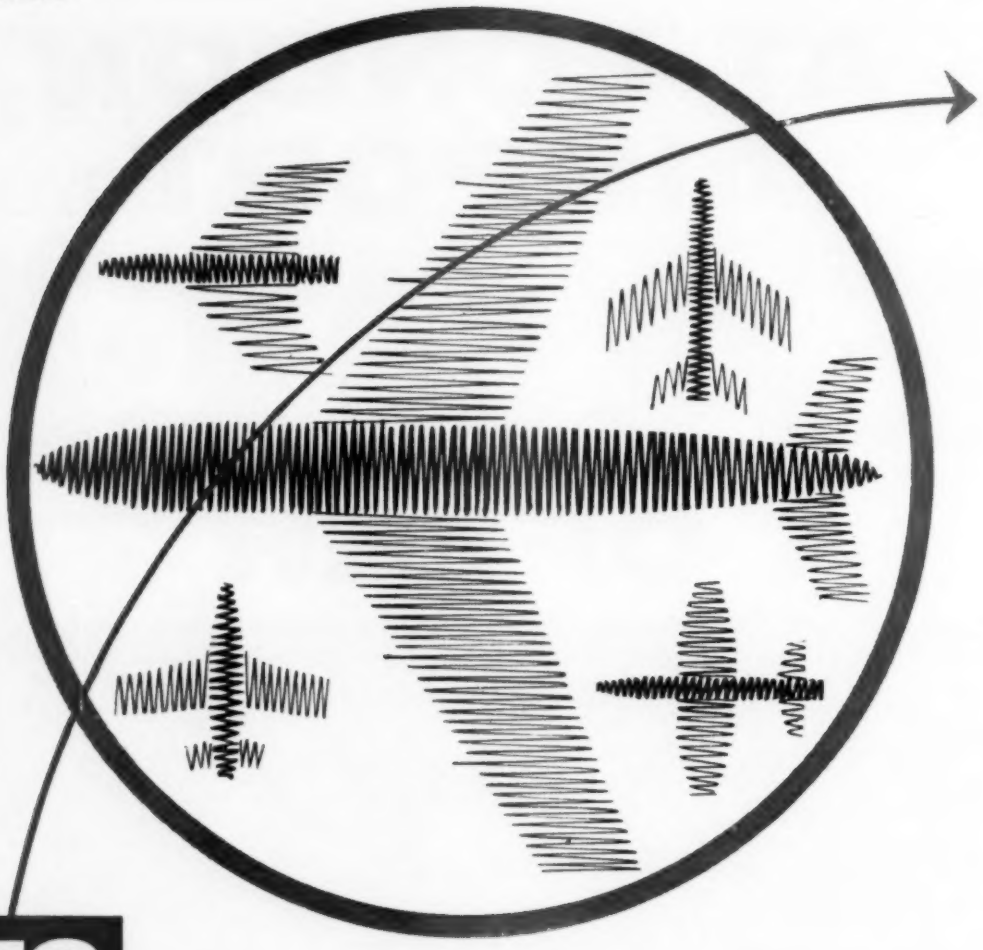
ALL TECHNICAL SERVICES CARRIED OUT TO A.R.B. STANDARDS IN FULLY APPROVED WORKSHOPS

Enquiries to: ***SALES MANAGER***

EAGLE AIRCRAFT SERVICES LTD

London Airport, Hounslow, Middlesex. Telephone: SKYport 3611

Telex: London Airport 25802



STC

radio interference suppressors for high temperature operation

A range of STC Suppressors employing metallised Melinex dielectrics, capable of operation at 125° C and 150° C, to suit the following aircraft applications:-

- ENGINE ELECTRICAL EQUIPMENT
- MAIN POWER GENERATING SYSTEMS
- SHORT TERM RATED MOTORS
- POWER SYSTEMS CONTROL EQUIPMENT

Among the aircraft for which STC Suppressors are specified are:-

COMET IV
BRITANNIA
VISCOUNT
HUNTER
192 HELICOPTER
VANGUARD
CANBERRA
TWIN PIONEER
P.1.
WESSEX HELICOPTER

RADIO INTERFERENCE MEASUREMENT SERVICE

The STC Radio Interference Measurement Service Department is approved by the Ministry of Aviation and the Air Registration Board for type testing of electrical equipment for Radio Interference and also for the design and development of suppressors and suppressor networks to the requirements of B.S.G. 100 and E.L. 1716, Section J.

Write for details of STC Interference Suppressors to:-

STC COMPONENTS GROUP

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2

CAPACITOR DIVISION: BRIXHAM ROAD · PAIGNTON · DEVON

60/SMC

PROBLEMS OR PROFITS?

Route pattern complexities of typical airlines demand a cargo aircraft with the capability of operating over both short and long route segments with excellent economy and earning ability. The Canadair Forty Four will do this for you! It combines the air cargo feeder liner with the long range aircraft to provide a standardized economic fleet unit. The Forty Four will give you profit-making operations, at current rates, over route segments as short as 200 miles and as long as 4,000 miles.

This is the type of flexibility that will answer the many and varied problems confronting airline operators who, because of the growing demands of shippers, are being forced to provide a combination of short, medium and long range air cargo services for the carriage of freight at attractive and competitive tariffs. In this situation, the Canadair Forty Four offers excellent economy and earning ability over the complete range of route structures that must be provided in the collection and distribution of air cargo.

Practical applications of this are found in the short route cargo services that are necessary in the supply and distribution of goods to or from the terminal points of trans-continental and trans-Atlantic services. This is evident between the major cities of the Eastern United States and between the principal points of Europe. These inter-city runs are essential extensions to the long haul trunk service, and with the Forty Four can be handled without a change of aircraft.

The need for this system of short, medium or long range operations will develop through the growing awareness among business establishments that the carriage of articles by air is becoming an essential element in the overall marketing function. This will open up new markets, new transportation requirements, new inter-city services. The Forty Four, with its flexibility of performance, can carry cargo at a profit over the whole distance spectrum—short, medium and long range, and has the airfield performance characteristics to get in and out of 85% of the world's major airports. THESE ARE DECISIVE ADVANTAGES IN FAVOUR OF THE FORTY FOUR.

SOME RUNWAY AND PAYLOAD SPECIFICS ON THE FORTY FOUR-D4

1. From runways as short as 6,000 feet, can operate with 70% payload up to stage distances of 3,000 miles.
2. Can operate from 85% of the world's major airports, with due consideration to both runway length and allowable wheel loading.
3. Will earn an operating profit with load factors as low as 30%.
4. Breakeven load factors in the Forty Four represent loss loads on larger proposed equipment.
5. Breakeven load factors on larger proposed equipment represent major profit payloads on the Forty Four.
6. Can operate *non-stop* on the London-New York route with an average annual payload of over 55,000 lbs.

CANADAIR LIMITED, MONTREAL, CANADIAN SUBSIDIARY OF GENERAL DYNAMICS

Please address enquiries to: **J. H. Davis, European Representative, Princes House, 190 Piccadilly, London, W.1**

B

within 40 seconds of starting from COLD

the WESSEX can be airborne and in full operational use. Powered by the Napier N.Ga. Gazelle free-shaft turbine engine, it is a new weapon for defence particularly in its anti-submarine role, capable of both search and strike sorties over a wide area.

The Wessex can carry a military load of 998 kg. over a range of 340 n. miles (630 km.) at a cruising speed of 100 knots (185 km./hr.). This most versatile of modern helicopters can be used in many other roles including ambulance, trooping (16 fully-equipped men), freighting, passenger transport (12 seats), crew training and carrier plane-guard.

Salient features of the Wessex include:—

* Quietness of operation.
* Considerably reduced maintenance and servicing commitment since the conventional cooling fan and clutch unit are no longer required.
* Rotors and Transmission parts are all backed by thousands of hours of in-flight proving.
* Complete Automatic Stabilization Equipment can be provided.
* In large scale production for the Royal Navy.
* Rapid conversion possible from one role to another.
* Can lift and fly with external loads of up to 4,000 lbs.

WESTLAND *the great name in* **HELICOPTERS**

WESTLAND AIRCRAFT LIMITED · YEOVIL · ENGLAND

Incorporating SAUNDERS-ROE LTD. FAIREY AVIATION LTD. and the BRISTOL DIVISION

THE AEROPLANE and ASTRONAUTICS

VOLUME 99 NUMBER 2544 JULY 22, 1960

Aero-electronics and Exports

No apology is needed for returning to the subject of Aero-electronics, to a survey of which we devoted a supplement last week; the wide field covered by the multiple applications of electronics to aviation becomes more important with every year that passes. This week we report the inauguration in the Netherlands of Phase 1 of the SATCO system. The equipment is the first of its kind installed at any airport in the World for routine operational use and in the opinion of those competent to judge is at least a year in advance of other automatic systems. As SATCO Phase 1 comes into use within the next three months at Schiphol, the air traffic control will be provided with a picture of traffic in the airspace under their surveillance more efficiently and more rapidly than anywhere else in the World.

Congratulations to our friends in Holland on their enterprise.

Meanwhile in our country there are serious misgivings. The British electronics industry is disturbed by reports of a Government decision to achieve short-term economies by not developing British military electronics equipment whenever a suitable product can be bought off the shelf abroad. This type of decision seems lamentably short-sighted. First, it is suicidal for a big nation to adopt a policy of buying arms: it is nearly as lethal as hiring mercenaries and history is full of examples of where that leads. Second, this kind of decision to turn off the tap so far as research and development is concerned effectively puts an industry out of running with competitors supported by their own governments. If we do not keep abreast of the times in developing export equipment how do we earn money to buy expensive equipment abroad?

It is not as though research and development were unfruitful in this island; how small was the expenditure that produced the radio location equipment which enabled Fighter Command to defeat the Luftwaffe. We have a current example of what our comparatively small research and development teams can achieve in the successful trials and demonstrations of the automatic landing system by the Blind Landing Experimental Unit at Bedford. Apparently the British lead in this field is so well established that the holders of the public purse cannot buy off the shelf anything better for the Royal Air Force. It might have been thought that in such happy circumstances the Government would have put all its weight behind a concentrated effort to sell the equipment to the air transport operators and airfield authorities of the World. It seems that such concerted effort has yet to be concerted.

Let us hope the light dawns before the darkness overwhelms us.

Supersonics in the Air

News from the U.S. suggests that the rise of international tensions has led to second thoughts about the decision to hold back on the B-70, the supersonic bomber on which the U.S.A.F. places such high hopes. Should the military production order be re-instituted in America, the chances of this country getting a supersonic civil transport into the air first will become very slim indeed. However, it has been reported that the Minister of Aviation is to make a statement on British plans before the House rises. Informed opinion is that the first step is likely to be limited to the placing of a study contract.

Editor - - - - - THURSTAN JAMES
Deputy Editor - - - - F. T. MEACOCK

Founder Editor (1911-1939) *C. G. Grey*

Proprietors: TEMPLE PRESS LIMITED
Chairman and Managing Director:
ROLAND E. DANGERFIELD

Editorial, Advertisement and Publishing Offices:
BOWLING GREEN LANE, LONDON, E.C.1

Telephone: TERminus 3636
Telegrams: "Pressimus London Telex"
Telex: 23839

Annual Subscription Rate: United Kingdom £4 15 0
Overseas £5 Canada and U.S.A. $15.00

© Temple Press Limited, 1960. The proprietors will consider any written requests to reproduce articles and illustrations appearing in this journal. Comment and brief extracts which acknowledge *The Aeroplane and Astronautics* are permissible.

Matters of Moment

When Will Blue Steel Be Operational?

HOW very slowly the wheels of defence planning revolve in these days of good living for all was made plain to see in recent Parliamentary Debates. In answer to CAPT. KERBY (Cons., Arundel and Shoreham), who had asked when a production order for Blue Steel Mk. 1 had been placed, Mr. Sandys in his reply on Jly. 8 said that the first order for a substantial batch for trials had been placed in December, 1955. "A further order," he continued, "will be placed shortly."

As there has been no mention of "operational" bombs there will be a general assumption that an order for such bombs has so far not been placed. In view of the widespread belief that the R.A.F. is to have the as yet non-existent Skybolt in a very short time, it should be salutary to have this reminder of just how long it takes to get these new devices operational, and also how long the Government takes to find the money to back an order.

As reported last week, Mr. Watkinson gave a written Parliamentary answer on Jly. 5 about the status of the Blue Steel stand-off bomb. It cleared up the misleading impression he had given in the Blue Streak debate when he implied that the stand-off bomb was in service. His answer said that development of the missile was going well and that launching trials were taking place. Although development of the Mk. 2 Blue Steel had been dropped, the possibility of improving the performance of the Mk. 1 was being investigated.

On Jly. 15 Mr. Watkinson faced a barrage of supplementary questions in the House of Commons as a result of his written answer a week before. But despite furious attack, he added little to his earlier answer, except to say that development rounds are being produced on a production line.

Considerable Parliamentary confusion had arisen because Mk. 1 V-bombers are being used for Blue Steel trials, but operational missiles will be carried by Mk. 2 bombers. These Mk. 2 V-bombers "are being fitted to carry the Blue Steel Mk. 1 bomb," according to Mr. Watkinson. But Mr. Sandys' answer implies that operational Mk. 1 bombs will not be ready for some time and the Mk. 2 V-bombers will probably be in service some time before the missiles they will carry.

Fuel Facts and Dangers

AT the Air Registration Board's annual luncheon in London last week, its chairman, Lord Brabazon of Tara, returned to his attack on the use of wide-cut fuel in civil turbine transports and its effect on the fire hazard. There were three airline operators, he declared, which were still using JP-4 instead of the much safer kerosene. This he described as a disgraceful practice. He would not disclose which were the airlines concerned—except to say that one was Belgian, one Canadian and the other American—but he roundly gave warning that unless these companies "mend their ways" he would name them within a few months so that it could be left to the passengers to decide whether they would face the extra hazard or not.

This sharp comment by Lord Brabazon brought a quick reply from one major overseas airline which clearly did not feel inclined to wait for any naming. Mr. Gordon McGregor, president of Trans-Canada Air Lines, was reported to have stated the following day in Ottawa that T.C.A. had chosen to use JP-4 only after the most rigorous technical study and that it was not necessarily more dangerous than kerosene. Kerosene, he agreed, was less inflammable than JP-4 under some conditions but the reverse was also true. There was a real safety advantage with JP-4 in certain in-flight conditions when static electricity and other factors became involved.

According to the same report from Canada there was also a retort from the Parliamentary Secretary to the Minister of Transport that JP-4 would not be used by airlines if it were considered unsafe.

These, however, were post-luncheon replies and no doubt there will be other exchanges. Another comment made by Lord Brabazon in his speech at the luncheon was to remind those present that we still had no non-inflammable hydraulic fluid.

He had something to say about the lack of good flight characteristics of some modern aircraft and remarked that their control systems left much to be desired. He paid a warm tribute to the Board's test pilot, Mr. D. P. Davies, for his outstanding contribution—particularly with reference to the Boeing 707. And he had some nice things to say about the A.R.B.'s chief executive Mr. R. E. Hardingham and its chief technical officer Mr. W. Tye.

"An impressive gathering of all the leaders of all the aspects of aviation," was how the Minister of Aviation, Mr. Duncan Sandys, the guest of honour, described the occasion. He made the point that the task of maintaining airworthiness needed precise judgment. If undue risks were taken, it might be very nice for the airlines and manufacturers but sooner or later there would be catastrophe; if the approach was overcautious, then sooner or later all aircraft would be grounded. A proper balance had to be struck and this is what the A.R.B. was so successful in doing.

MEN OF THE MOMENT.—Left to right, Sir Wilfred Neden, deputy chairman of B.O.A.C.; Rear Admiral Sir Matthew Slattery, chairman; Mr. Basil Smallpeice, managing director of B.O.A.C., all at the GAPAN party on Jly. 8.

Speaking of the future and supersonic airliners Mr. Sandys referred to the problem of supersonic bangs and the disturbances caused by aircraft noise. He felt that the noise from supersonic aircraft had not yet been really considered. This matter was a challenge to the scientists and manufacturers and he hoped that it would receive urgent attention.

Major R. H. Thornton proposed a spirited and entertaining toast to the guests to which Mr. P. G. Masefield replied with his usual ready wit. As usual this was a most pleasant occasion and a fitting highlight for the A.R.B.'s twenty-third year of existence. It was certainly a most distinguished company and among the guests in addition to the Minister of Aviation was the Secretary of State for Air and the Permanent Under-Secretary.

Return of the Supersonic B-70

TOP-PRIORITY development of the Mach-3 B-70 bomber will almost certainly be resumed in the U.S.; last December the project was "reorientated to a prototype programme" and seemed likely to appear only as a research aircraft. But the decision has been fought vigorously by the U.S.A.F. and this, combined with the change in the international situation, has led the U.S. Congress to vote $190 million in the 1961 defence budget for development of the bomber as a full weapon system. This money is additional to the $75 million originally requested to produce two prototypes. Before the increased allocation takes effect it must be approved both by the Bureau of the Budget and the Secretary of Defense.

The cutback in the B-70 programme was deplored by the U.S.A.F. It was regarded as marking the end of the mixed-force concept in which manned aircraft and missiles form an integrated deterrent. The U.S.A.F. considers that the B-70 can be used for reconnaissance, as a missile and space-vehicle launcher, and as a supersonic transport.

Powered by six General Electric J93 turbojets, the aircraft is intended to cruise at more than 2,000 m.p.h. over an unrefuelled range of 8,000 miles; its operational ceiling will be 80,000 ft. It will weigh about 500,000 lb. and the span of its delta wing has been quoted as 115 ft. with an overall length as 170 ft.

Another argument favouring active development of the B-70 has been the commercial benefits it will bring. Rapid development of this aircraft will greatly affect the speed with which U.S. manufacturers can produce a supersonic civil transport. Experience in propulsion, structures, systems and operation of a long-range Mach-3 aircraft will give the U.S. industry a big advantage in developing supersonic airliners; practical experience of this kind will not be available to the British aircraft industry.

Selling Malkaras

FAIREY ENGINEERING, LTD., has been appointed sales agent for the Malkara anti-tank missile in all countries except the United States. The Australian Department of Supply has also appointed it the authority in the U.K. to assist in the introduction of the complete Malkara weapons system, which is on order for the British Army, and to design and produce modifications as required.

The Secretary of State for War has announced that some 400 Malkaras have been ordered at a cost of about £1 million and that others will follow. He stated that "Malkara is air-portable, accurate, highly lethal against the heaviest tank at considerable range, and is already in production."

This wire-guided missile weighs about 200 lb. and is 5 ft. long. It can be mounted on any armoured vehicle.

The Malkara carries small flares on its wing-tips to allow the controller to follow its flight path. Its range has not been disclosed, but at a demonstration in June a Malkara made a direct hit on a target more than a mile away. The missile is to enter service with the Royal Armoured Corps in 1961.

Fairey Engineering, Ltd., is the member of the Fairey Group responsible for guided weapons, target aircraft and aircraft hydraulics. Its headquarters are at Heston, in Middlesex, where Malkara design work will be carried out, and it has a production factory at Stockport, Cheshire.

This Saturday's Show

FOR the first time the Army Air Corps is to give a public display. This will take place from 14.30 hrs. onwards at Middle Wallop Air Station, near Andover, on Saturday, Jly. 23. Two unusual aircraft scheduled to appear are the Wallis-Bensen Autogyro, described in THE AEROPLANE AND ASTRONAUTICS on Aug. 28 last, and what the Air Corps chaps call the Flying Li-Lo, which is an inflated-wing machine.

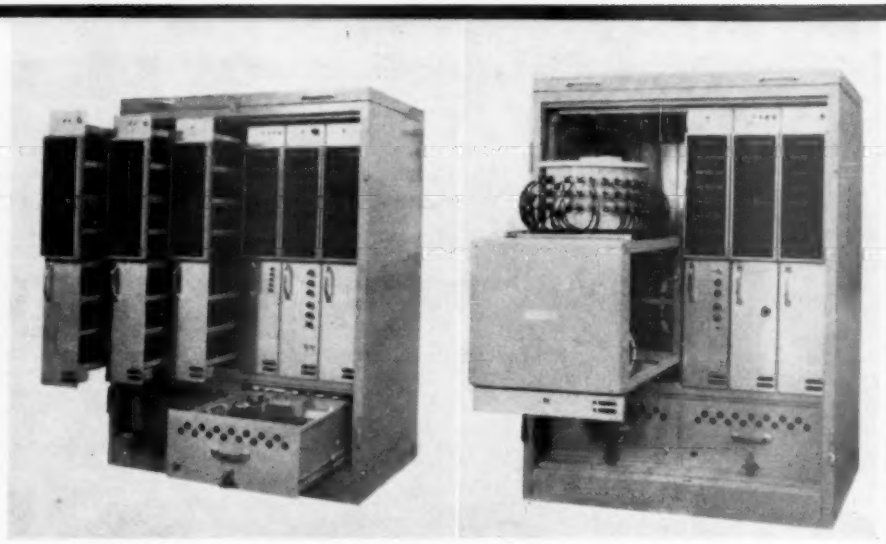
There will be formation flying by fixed-wing and rotary-wing aircraft of the A.A.C., competition flying, a dummy shoot by guns of the 3rd Regiment, R.H.A., controlled by spotter aircraft of 651 Air Observation Flight, A.A.C. The Bristol Fighter is to give a demonstration and there will be a demonstration by the R.A.F. Gliding Club.

The Army Air Corps was formed in September, 1957, from those R.A.F. units which provided air observation and light liaison for the Army. The outward and visible sign of the Corps is a sky-blue beret and a noticeable air of high morale.

Photograph copyright "The Aeroplane and Astronautics"

COURT IN BEING.—His Royal Highness the Prince Philip, Grand Master of the Guild of Air Pilots and Air Navigators at a meeting of the Court on Jly. 7. On his right, Dr. K. G. Bergin, the Master. The other members: Seated L. to R., The Rev. Norman Motley (Hon. Chaplain), Capt. B. C. Frost (Warden), Wg. Cdr. C. A. Pike (Warden), E. B. Trubshaw (Warden), Capt. J. T. Percy (Warden), J. Lankester Parker (in attendance, Chairman, Benevolent Fund Board of Management), Capt. M. R. Aries (Warden), Sir Alan Cobham (Assistant), A. M. A. Majendie (Assistant), Capt. D. F. Satchwell (Assistant), Capt. E. L. Gosling (Assistant); (seated in front), Capt. O. P. Jones (Past Deputy-Master), J. C. F. Ritchie (Assistant); (standing, L. to R.) Capt. D. J. Turner (Assistant), Capt. A. Caesar-Gordon (Assistant), Capt. T. H. Farnsworth (Assistant), Capt. A. S. Wilcockson (Assistant), V. C. Varcoe (Hon. Clerk), Capt. N. C. Green (Assistant), Sqn. Ldr. F. R. Leatherdale (Assistant), L. W. Wenman (in attendance, Chairman, Panel of Examiners).

SATCO Inaugurated at Schiphol



The two units of the SATCO computer are, left, the data processing cabinet and, right, the magnetic memory drum cabinet.

AUTOMATIC air traffic control came a stage closer to realization last week when the necessary equipment to operate Phase 1 of the SATCO system at Schiphol Airport, Amsterdam, was formally delivered. Produced by N.V. Hollandse Signaalapparaten, the equipment was received on behalf of the Netherlands Government by the director-general of the department of civil aviation. It is the first of its kind installed at any airport in the World for routine operational use, and is probably a year in advance of other automatic systems under development in the U.S.A. and elsewhere.

SATCO was extensively described in our issue for Jly. 5, 1957, after THE AEROPLANE had inspected the laboratory model at the maker's Hengelo works. In April, 1958, Signaal—in which N.V. Philips has a 51% interest—received its first contract from the Netherlands Government, covering the construction and installation of the Phase 1 equipment which was handed over last week. This is to be followed by Phase 2, providing automatic flight progress boards by April, 1962.

Phase 1 equipment provides for the automatic calculation of flight paths for all aircraft in the Amsterdam F.I.R. and the automatic preparation of flight progress strips for use in the airport control centre. The components for this are an electronic computer which is fed with information from aircraft flight plans or from messages transferring control of an aircraft from adjacent air traffic control centres; and two modified teleprinter receivers which print the results of the computer's calculations on specially prepared flight progress cards.

From the basic flight data provided, the computer calculates the flight path of the aircraft and its height and time at the various reporting positions, printing a card to show this data for each position. The two teleprinters are, respectively, for westbound and eastbound flights, printing on different coloured cards and selected automatically by the computer. A master record of all messages is printed on a continuous strip.

This is SATCO at its simplest. A number of other functions can be added, both at the present Phase 1 stage and later in Phase 2. Data can, for instance, be transferred to adjacent control centres semi-automatically by teleprinter, and provision is made for automatic correction of data if the runway-in-use is changed.

Phase 2 will provide for the automatic presentation of data on flight progress boards and therefore represents a most important forward step in air traffic control. Electro-mechanical indicators are used to build up the information at present shown on the flight progress cards, with about 30 indicators for each "card" and an average of 12 such progress strips for each airfield or reporting position on the console.

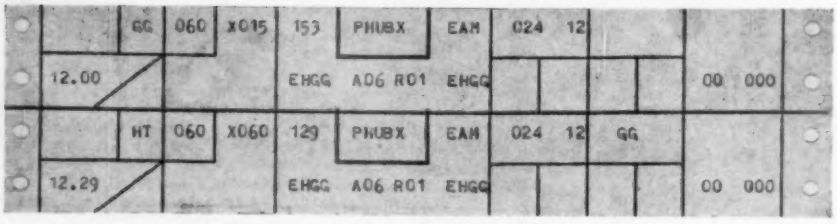
In addition to this automatic display of data, which is automatically up-dated as new information comes in to the computer, Phase 2 will provide for a simple degree of conflict search, and for the direct input of information from radar. Using a specially designed transistorized PPI, radar-derived positions can be fed into the computer semi-automatically.

Beyond these first two stages—which together represent about as far as it is possible to go towards automatic A.T.C. in the immediate future—Phase 3 of SATCO would provide for more complex conflict search with automatic resolution of such conflicts and calculation of "next best" flight paths; and dynamic displays of calculated situations on "clear-view" displays which show the position of the aircraft in three dimensions. Phase 4 would represent automatic conflict resolution and automatic input from and control of radar equipment.

A great deal of interest has been shown in SATCO in European countries and elsewhere, but there has been a reluctance in several cases to purchase such equipment abroad. Arrangements may be made by Signaal, therefore, to sell the "system" without necessarily providing all or any of the components from Holland. In the case of the U.K. arrangements might be made through Mullard, another Philips subsidiary.

Meanwhile, however, while Britain and other nations are experimenting, the Netherlands will be consolidating an already-useful lead. As SATCO Phase 1 comes into use within the next three months, the controllers at Schiphol—who have been consulted at all stages of SATCO development and have contributed a great deal of practical advice—will have a more accurate picture of the air traffic in their area, more quickly, than can be obtained probably in any other centre in the World.

At a later stage in the SATCO programme at Schiphol, information from this newly operational long-range radar will be processed automatically by the computer.



These two flight progress strips were printed by the SATCO equipment at Schiphol. They are for the same aircraft (call-sign PH-UBX) at two reporting positions which, the computer has calculated, will be reached at 12.00 hrs. and 12.29 hrs. respectively.

More Changes at Bristol

THE aircraft sales and service departments of Bristol Aircraft, Ltd., are being amalgamated because the company feels that the interests of its airline and military customers can be better served by a closer co-ordination of these particular activities. Three new appointments have been made as a result of this change. Mr. Walter F. Gibb, chief test pilot, becomes sales and service manager, aircraft. Mr. Roger White-Smith, sales manager, becomes deputy sales and service manager, aircraft. Mr. Godfrey Auty, deputy chief test pilot, succeeds Mr. Gibb as chief test pilot. Mr. J. C. Harrington, who until now has been service manager, aircraft, is giving up his appointment with the company at the end of July.

Mr. Gibb has been chief test pilot of the company since 1957. Born in 1919, he joined the Bristol engine division as an apprentice in 1937. He left to join the R.A.F. in 1940 and in 1946, returned to Bristols as a test pilot. During the past eight years he has been responsible for much of the test and development flying on Britannia aircraft which he has also captained on a number of overseas tours.

Mr. Auty, who is 39, has been the company's deputy chief test pilot since December, 1957. He joined the R.A.F. in 1940, serving with the 2nd Tactical Air Force, South-East Asia Command and, after the War, as a ferry pilot. He went to Bristols in 1951. Mr. Auty has carried out a considerable amount of the development flying on Britannias and, before the formation of Bristol Siddeley Engines, Ltd., handled a great deal of Bristol engine development flight testing, flying such aircraft as the Vulcan, Sabre, Fiat G91, and Gnat. He will pilot the Type 188 stainless steel supersonic research aircraft.

Mr. Roger White-Smith, who is 36, has been sales manager of Bristol Aircraft, Ltd., since the beginning of 1956. He joined the Bristol Aeroplane Co., Ltd., in 1947, and was for two years assistant to the chief personnel manager. He became personal assistant to Sir (then Mr.) Reginald Verdon Smith in 1949 and in 1951 joined the aircraft sales department, becoming deputy sales manager 1955.

Fringe Reconnaissance and the RB-47

AN international incident similar in scale to the U-2 affair was triggered off last week by the Russian announcement that they had shot down a U.S.A.F. RB-47 reconnaissance aircraft over the Barents Sea and that two crew members had been captured alive. This was the RB-47 which had been declared missing by the U.S.A.F.; it had taken off from Brize Norton in Oxfordshire on Jly. 1 for an electro-magnetic survey flight north of Norway. Not until Jly. 11 did the Russians announce that it had been shot down by a fighter over their territorial waters near Cape Svyatoy Nos, on the Kola Peninsula.

No details have been given about the type of RB-47 concerned, although it was probably an RB-47H the "special" reconnaissance version of the six-jet B-47 bomber. This type of bomber is now approaching obsolescence—the prototype first flew in December, 1947, and the first flight of a production aircraft was in June, 1950.

More than 2,000 B-47s of different marks were built before production ended in February, 1957. The type still plays an important rôle in Strategic Air Command, although medium bomber wings are now being re-equipped with B-58s. In addition to the primary bombing rôle, B-47s are used as flight-refuelling tankers, for crew training, for weather flights, as target drones and for reconnaissance duties.

Reconnaissance versions of the aircraft have been developed from the basic bomber, the main external difference being a lengthened fuselage nose. The RB-47B was a high-altitude photographic reconnaissance version of the B-47B and similarly the RB-47E is a long-range day or night photo-reconnaissance version of the B-47E, the final production bomber.

Later reconnaissance types are the RB-47K and RB-47H; both are similar to the RB-47E, the first being equipped for both weather and photographic reconnaissance, and the second for "special" reconnaissance. This vague designation probably covers a range of duties including oblique radar mapping and reconnaissance, and the monitoring of radio and radar transmissions during fringe flights close to the borders of a potential enemy country.

The RB-47 lost over the Barents Sea had a crew of three electronic specialists in addition to its normal flight crew of three. This would suggest that it was in fact an RB-47H.

Although an aircraft of this type is well suited for fringe flights, it is unlikely that it would be purposely sent over Russian territory. The altitude and speed at which a B-47 cruises would make it a relatively easy target for the latest fighters; it does not cruise high enough to enjoy the immunity of a Lockheed U-2.

A close approximation to the performance of the RB-47H is given by the figures for the B-47E, although the range of the reconnaissance aircraft is probably greater and, as with the bomber, can be increased by flight refuelling. Service ceiling of the B-47E is 42,000 ft., and it has a range of 3,200 miles when cruising at 495 m.p.h. at 40,000 ft. The aircraft is powered by six 6,000-lb. s.t. General Electric J47 turbojets and has an all-up weight of 200,000 lb.

Clearly an aircraft of this type, with a performance well below that of British V-bombers, is unlikely to have been chosen for an espionage flight over Russia, although its mission might have been "legitimate" espionage on the fringe of Russian territorial waters. No details are likely to be given about the purpose of its flight; speculation has suggested that it might have been checking on electro-magnetic effects which could influence the accuracy of the BMEWS early-warning chain or, alternatively, gathering information about Russian radar sites But, according to the United States, it was on an "entirely innocent mission."

BOEING RB-47H.—This version of the B-47 is used for special reconnaissance missions; the aircraft lost in the Barents Sea was probably of this type. Wing and fuselage blisters for special radio and radar equipment can be seen in this photograph, which is the first to be published of an RB-47H.

Aviation News in General

REDSTONE - MERCURY. — Programme of sub-orbital tests for the Mercury man-in-space programme has fallen behind schedule. First firing of a Redstone-Mercury will probably occur in September with an instrumented McDonnell capsule. A simian will be carried in a second or third Redstone and—if all goes well—a man in the fourth.

MERCURY CHIMP.—A chimpanzee will be the occupant of a Mercury capsule to be launched shortly by the last Little Joe rocket to be fired from Wallops Island. Production MA-1 capsule will be used in this limited-range recovery test. Atlas-Mercury (Big Joe) sub-orbital tests will follow from Cape Canaveral.

ORBITAL ATLAS.—NASA hope to launch an Atlas-Mercury test-vehicle into orbit this November. Object will be to attempt recovery of an instrumented MA-1 capsule. Early next year, a chimpanzee now under training at Holloman A.F.B. will be launched in the production capsule in a dress rehearsal for the three-orbit, 4½-hr., manned experiments to follow.

REVAMPED SKYBOLT.—Latest configuration of the Douglas GAM-87A Skybolt is said to have a first stage controlled by steerable tail fins and a second stage controlled by swivelling nozzles. Total length is 25 ft., max. dia. 36 in. Weight has been reduced from about 15,000 lb. to between 9,000 and 10,000 lb. Launch altitude is given as 40,000 ft., range, 1,000 miles and duration of ballistic flight, 10 min. Weapons System number is WS-638A.

NUCLEAR RAMJET.—Chance Vought have put up a scheme for a nuclear ramjet-powered missile under the SLAM Project. With a reactor diameter of about 5 ft., missile would be 70 to 80 ft. long with a body diameter of 10 ft.; it would have no wings. Noseflaps would be used for control.

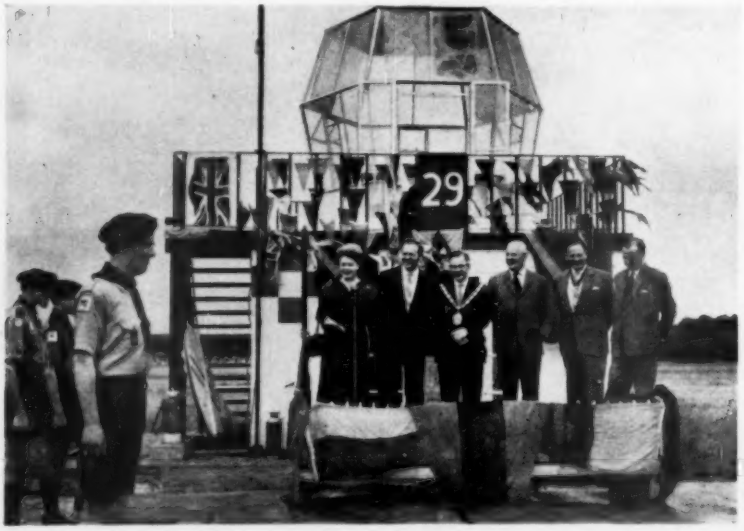
CONRAD AGAIN. — Indefatigable Max Conrad, holder of two straight-line records in Piper Comanche N110LF, took off in it on Jly. 4 to attack the closed-circuit record for aircraft up to 3,858 lb. gross. Sixty hours later, he landed back at Minneapolis-St. Paul having more than doubled the previous Czech Meta-Sokol record by flying 6,921.28 miles non-stop. The Comanche 180 had 295 Imp. gal. of fuel when it started, but only the normal eight quarts of oil.

ARGOSY CORRECTION.—The altitude ranges for the AWA Argosy's limiting speeds were inadvertently reduced from 0-10,000 ft. to 0-1,000 ft. in our article on its Middle East route-proving flight (Jne. 24, page 761). These placard speeds should read: V_{NE} 0-10,000 ft. 265 kt. I.A.S. decreasing 5 kt. per 1,000 ft. to 25,000 ft.; V_{NO} 0-10,000 ft. 230 kt. I.A.S. decreasing 4 kt. per 1,000 ft. to 25,000 ft.

BLACKBURN JUBILEE.—On Jly. 12 the 50th anniversary of the start of flying from the Filey foreshore was celebrated. The event included a landing and take-off with the sole surviving Blackburn B-2.

RUSSIAN ROTOR CYCLE.—An ultra-light helicopter is expected to begin its flight trials in Russia in the near future. It is the product of B. A. Aunap who has been developing an aircraft of this type for several years. The engine is by V. Polyakov.

SAAB NEWS. — The Saab 35-B Draken, powered by a Rolls-Royce Avon RB.146 with a Swedish afterburner, exceeded Mach 2 in level flight for the first time last January. As well as producing Drakens and Safir trainers, Saab is building Sud Alouette II helicopters under licence for the Swedish Services. Alouette IIIs are also to be produced.



CONTROLLED OPENING.—Biggin Hill's new private enterprise control tower was officially opened on Jly. 9 by Miss Pat Hornsby-Smith, M.P. Next to her is Mr. Edward Drewery, who was responsible for its construction.

CARAVELLE TESTS.—During the night of Jly. 7-8, the Caravelle on fatigue test at the E.A.T. completed its 100,000th simulated flight (see our issue for Jly. 1, p. 9, for details of these tests). Recent studies have allowed Sud-Aviation to reduce the Caravelle's guaranteed landing distance to 4,800 ft. at the typical landing weight of 86,000 lb.

WRONG NUMBER.—In the General Precision Systems, Ltd., advertisement which appeared in our Jly. 15 issue the telephone number was incorrect. It should have read Ealing 1845 and not 845.

REVERSER TESTS.—General Electric has begun wind tunnel testing on a Caravelle 7 to determine the effects of using reverse thrust on its CJ-805-23 engines. The reverser, which is designed to deliver 6,000 lb. of reverse thrust, stows externally, becoming part of the after-body of the short-cowl nacelle. Delivery of a Caravelle to General Electric is scheduled for the same time this month.

CHAIN REACTION. — Sayed Jamoussi, director-general of civil aviation in the Yemen, is reported to have been put in chains, on orders of the Imam, following the crash of a Russian helicopter near Taiz. The Governor of Aden, Sir William Luce, was a passenger in the Mi-4, which the D.G.C.A. is said to have permitted to fly despite warnings from the Russian pilot that it was overloaded.

BRITISH PARACHUTE TEAM.—Final selection of the team to represent Great Britain in the fifth World Parachuting Championships to be held at Moustechevo, Bulgaria, Aug. 7-17, took place at Woburn Abbey, Bedford, on Jly. 16. After these eliminating trials, the team was announced as Mike Reilly (captain), Tony Charlton, Denis Lee and Mike McArdle from the Skydivers Club, and Flt. Lt. Peter Hearn from R.A.F. Abingdon. The team will also take its own pilot.

Commercial Aviation Affairs

GOING UP.—Increases of 25% in the number of passengers and 24% in freight picked up and set down were recorded at U.K. aerodromes in May, 1960, when compared with May, 1959, according to M.o.A. figures. The number of air transport movements increased by 12% and the number of passengers handled at London Airport was up by 30%.

DOING WELL.—In the last week of June, B.O.A.C. sold 98% of the 7,933 seats on flights from Canada and the U.S.A. to Britain. Capacity offered was 36% higher than in the same period last year and passengers carried increased by 40%. On 25 east-bound services over the week-end of Jly. 2-3, only six seats out of 2,277 were not sold.

CONGO EVACUATION.—By last week-end Sabena had flown some 14,000 refugees out of the Congo Republic. On one flight a Boeing 707 carried 293 refugees and a crew of 10 out of Leopoldville—a remarkable performance which the company claims as a World record for civil operations.

ANGLO-PORTUGUESE LINK.—British and Portuguese delegations, including airline advisers, have agreed in principle the text of a new Air Services agreement. They also agreed to encourage the fullest possible measures of co-operation between their airlines.

707 FOR LEASE.—Current *Market Report* of the Aircraft Exchange includes an offer to lease, for from three to 18 months, a new Boeing 707-420; price asked is $1,300 per hour. This 707 is immediately available for "wet or dry" lease, but the owners (unspecified but probably Varig) stipulate that it should return to New York for maintenance after every 60 hours.

QANTAS TO PERSIA.—Under the terms of an air agreement signed by Australia and Persia last week, Qantas will have operating rights through Persia on its round-the-World service and Persia will have reciprocal rights for a service to Australia.

I.T.A. APPOINTMENTS.—The Institut du Transport Aerien has appointed as honorary chairmen H.R.H. Prince Bernhard of the Netherlands and Prof. Theodore von Kármán.

AIR-SEA INTERCHANGE.—IATA and TAPSC (Trans-Atlantic Passenger Steamship Conference) have made arrangements for their member carriers to become parties to a standard agreement allowing passengers between North America and Europe and the Mediterranean to travel one way by ship and the other by air. The standard agreement will replace individual agreements made between companies and has already been signed by 23 TAPSC and 33 IATA members.

FOUR INTO ONE.—In the first overseas airlift of Beech aircraft from the Wichita factory, three Debonairs and a Bonanza were flown recently to the German distributor in Bremen in a Lufthansa Constellation.

NEW FREQUENCIES.—The F.A.A. began using nearly 300 new radio frequencies on Jly. 7 for air traffic control purposes. These, and another 200 new frequencies to be introduced over the next three months, are in five additional megacycles and will be used primarily for en route control.

AIRLINE PACT.—In future charter and non-schedule companies will be barred from M.A.T.S. contracts for carrying personnel or cargo. Such contracts will be negotiated direct, instead of by competitive bidding, with scheduled U.S. airlines only.

DME ORDERED.—The first F.A.A. contract for TACAN-compatible DME equipment to be added to existing VOR stations has been placed with the International Telephone and Telegraph Co. It is for 20 sets and spares at a total cost of $856,000.

LIVERPOOL STREET TERMINAL?—As an alternative to providing a station to serve Southend Airport, the British Transport Commission has offered terminal facilities for air passengers at Liverpool Street Station. In the first six months of this year, 129,000 passengers and 18,000 tons of freight passed through Southend.

PACIFIC ESCAPE.—Only one life was lost when two airliners carrying between them 89 persons ditched in separate incidents near Manila on Jly. 14. A Northwest Airlines DC-7C on a flight from Seattle, Tokyo and Okinawa to Manila ditched about 90 miles from Manila after one propeller had run-away and the wing caught fire. All but one of the 51 passengers, and the crew of seven, were rescued by U.S.A.F. aircraft. A Philippine Air Lines DC-3 on a flight from Manila to Zamboanga ditched in shallow water near Bais in the Oriental Negros with fuel running low in bad weather. All 31 occupants were rescued.

DANISH ACCIDENT.—A Dragon Rapide operated by Zone-Rednings-korpset crashed after take-off from Kastrup Airport, Copenhagen, on Jly. 16. The eight passengers—members of a national football team—were killed and the pilot was severely injured.

News About People

NORMALAIR IN INDIA.—Mr. George Wilmott, one of Normalair's service engineers, is to be based in India for three years. With headquarters initially in New Delhi he will act as consultant on all Normalair-equipped aircraft in India, Pakistan, Malaya, and Burma, and will also give technical assistance and maintain liaison with the company at Yeovil.

BRISTOL APPOINTMENTS.—Following the appointment of Mr. J. B. Mackirdy, formerly deputy chief inspector of Bristol Aircraft to be works manager of the company's Cardiff factory, Mr. R. A. Horrex becomes deputy chief inspector (aircraft); and Mr. K. L. Smith deputy chief inspector (guided weapons). Mr. R. L. Hard becomes inspection administrator at the factory.

AERO-SCIENTIST.—H. E. Wimperis, C.B., C.B.E., M.A., D.Eng., F.R.Ae.S., Hon. Fellow, Imperial College, London, who died on Jly. 16 in Edinburgh aged 83, was Director of Scientific Research at the Air Ministry from 1925 to 1937. He was R.Ae.S. president 1936-38.

RADAR PIONEER.—Air Marshal Sir Raymund Hart, K.B.E., C.B., M.C., who died on Jly. 17, joined the Watson-Watt team at Bawdsey in 1936. He became chief signals officer with the A.E.A.F. and afterwards with S.H.A.E.F. An obituary notice will appear next week.

POLISH DESIGNER.—Mr. Zbyslaw M. Ciolkosz, a distinguished Polish designer, died recently in the U.S.A. Before the War he worked for the PWS, PZL and LWS factories and designed, among other types, the PWS 20 transport in 1929 and the PZL 30 Zubr twin-engined bomber. During the War he was head of the aviation department of the Polish Government in Exile, and subsequently worked with the English Electric, Piasecki, Hiller and Boeing companies.

Air Transport

Sharing the Development Costs

FOR the Government to share in financing the development of the next generation of subsonic transports was both necessary and—in the light of the new policy towards the aircraft industry adopted after the last General Election—foreseeable. Mr. Duncan Sandys' guarded statement to the House of Commons earlier this month, to the effect that a decision had been reached "in principle" to support the DH121, the Argosy, the VC10 and the Super VC10 does little more, in fact, than confirm the earlier implicit promises to reward the industry for its acceptance of the major regrouping favoured by the Government.

According to the Minister's statement on Feb. 15, State aid can be in any of three categories, covering a contribution toward the development, tooling or other initial costs of launching a new type; a share in the risks involved in producing aircraft beyond those already ordered; and a contribution toward proving costs prior to introduction into airline service. The extent of Government participation in any one project will never exceed half the total cost involved and arrangements will be made for the Government to share in the proceeds from the sale of each type.

The form and the value of the contracts to be negotiated in respect of these four aircraft have not been disclosed. All four, as we pointed out last week, have already been ordered, although none yet in break-even quantities. The Government's intervention is presumably intended to secure these projects against the possibility that the British Aircraft Corporation and the Hawker Siddeley Group should find it difficult to provide for their effective and speedy development.

It has always been clear that such a policy was a reversal of earlier Government thinking, which had required the aircraft industry to develop new civil aircraft purely as private ventures. Indeed, the Government's insistence on this very point indirectly delayed, by almost a year, a start being made on the new B.E.A. jet aircraft which, as the DH121, is now to become State-aided. This fact alone underlines how great has been the change of Cabinet viewpoint in the past year.

The VC10 family and the DH121 rank as the most important civil projects of the British industry today, and their inclusion high on the list qualifying for Government support was inevitable once the change in policy had been decided. The inclusion also, at this stage, of the Armstrong Whitworth Argosy is at first glance a little more difficult to explain, if only because the R.A.F. orders for 40 of the military AW660s represent a fairly substantial, if retrospective, contribution to development costs. In the absence of an order for the civil AW650 from one of the two Corporations, however, Government aid serves the double purpose of demonstrating official confidence and speeding deliveries to overseas customers.

A number of other aeroplanes—as we showed in our issue for Feb. 26—could be said to qualify for assistance in some form. The Rotodyne, major project of the Westland group, is already being backed, and the intention of purchasing three examples each of the Handley Page Herald and Avro 748 has been announced, although in neither case has a contract yet been signed. It remains to be seen whether the Government is prepared to gamble on a project prior to firm orders being placed.

Both the British Aircraft Corporation and the Hawker Siddeley Group have turbofan-powered short-haul transports in the design study stage, and, as we said in our issue for Apr. 29, the production of one of these aircraft is becoming an urgent necessity if this promising market is to be captured. A similar act of faith may be called for to initiate development of a vehicle ferry/air bus for which the known market is small but the possibilities considerable.

TRIALS BEGIN.—On Jly. 9 the first of T.C.A.'s 23 Vanguards began its C. of A. development flying. The programme includes performance and systems work. Differences between the B.E.A. and T.C.A. Vanguards include revised air conditioning and water systems, the use of Skydrol hydraulic fluid and the more powerful Tyne R.Ty.11 engines.

Eximbank Record

SINCE the U.S. Export-Import Bank (Eximbank) of Washington was formed in 1934, it has extended credits to foreign airlines for the purchase of 145 transport aeroplanes having a total value of more than $242 million. Some 63% of these loans have been made in the past five years, indicating the growth of Eximbank aviation activity with the introduction of turboprop and turbojet aircraft. The total includes $197 million for 99 aircraft purchased by the flag carriers of 14 nations, and $45 million for 46 aeroplanes bought by private airlines in seven countries, including two loans of $1,100,000 each for a U.K. operator. In addition, some $30.5 million has been lent, mostly in the past 10 years, for the purchase of airport equipment and development of airports.

Eximbank offers several types of loan with varying rates of interest depending on the types and duration of risk. In one standard formula, the foreign buyer makes a 20% down payment and Eximbank finances 85% of the balance of the purchase price, leaving the exporter to finance the remaining 15%.

In order to extend the export of aircraft spares, used aircraft, light or general-type aircraft and helicopters, Eximbank is now offering short-term "package" deals which include guarantees for "political" risks as well as the normal commercial risks. These "political" risks, for which Eximbank will pay the exporter 90% of his losses, include such things as cancellation of an import licence; war, hostilities, rebellion or civil commotion; and expropriation of exported items by foreign authorities.

44

AIRLINES HAVE CHOSEN . . . VISCOUNT

All Nippon Airways of Tokyo — three Viscount 810's ordered! Ghana Airways—three also! This now makes forty-four airlines with Viscounts in service or on order, as listed opposite. Five Governments and seven private companies or individuals also operate Viscounts.

22

HAVE RE-ORDERED . . . VISCOUNT

Of these forty-four airlines, twenty-two have now placed repeat orders for Viscounts.

2,500,000

HOURS HAVE BEEN FLOWN BY . . . VISCOUNT

This impressive total includes half a million revenue hours flown by BEA up to April 1960.

EUROPE
British European Airways
Air France
Aer Lingus
K.L.M.
Lufthansa
Alitalia
Austrian Airlines
Turkish Airlines
Airwork
Hunting Clan Air Transport
Tradair
Transair
Eagle Aviation
Icelandair

NORTH AMERICA
Capital Airlines
Continental Airlines
Northeast Airlines
Trans-Canada Air Lines
Maritime Central Airways

CENTRAL AND SOUTH AMERICA AND CARIBBEAN
Vasp (Brazil)
Pluna (Uruguay)
L.A.V. (Venezuela)
Lloyd Aereo Colombiano
TACA (El Salvador)
British West Indian Airways
Cubana

MIDDLE EAST
Middle East Airlines
Misrair (Egypt)
Iraqi Airways
Iranian Airways
Kuwait Airways

AFRICA
Central African Airways
Sudan Airways
South African Airways
Ghana Airways

SOUTH EAST ASIA
Indian Airlines Corporation
Pakistan International Air Lines
Union of Burma Airways
Malayan Airways

AUSTRALASIA
Trans-Australia Airlines
Ansett-A.N.A.
New Zealand National Airlines Corporation

PACIFIC
Philippine Air Lines
All Nippon Airways

VISCOUNT
FOUR ROLLS-ROYCE DART TURBO-PROP ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY
MEMBER COMPANY OF BRITISH AIRCRAFT CORPORATION

TSA AYS 60

D

Parachutests 4

KEY: 1. Observing the oscillation of stores in descent:
2. Measuring clearance of tail wheel:
3. Firing test:
4. Test to determine strength of material:

G.Q.

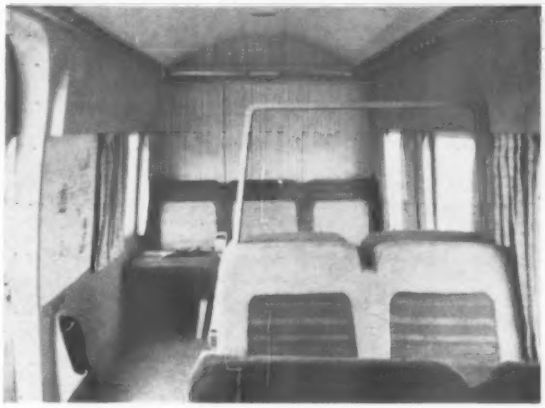
G. Q. PARACHUTE COMPANY LIMITED

STADIUM WORKS · WOKING · SURREY · ENGLAND

Telephone: Woking 2277

Air Transport . . . .

CERTIFIED.—On Jly. 6, the Sikorsky S-62, with a General Electric T58 shaft turbine, was granted an F.A.A. Type Certificate for commercial operations carrying up to 11 passengers. The interior shown here was styled by Raymond Loewy Associates.



Eland-Convair Costs

ON the basis of nine months of operation with the Napier Eland-powered Convair 540, Allegheny Airlines has estimated total direct operating costs of this aircraft in future to be 95.36 cents per aircraft revenue mile. In data submitted to the C.A.B. for the hearing of a Buffalo-Toronto route case, Allegheny said that the cost per available seat-mile for its fleet of five 52-seat Convair 540s, on stage lengths up to 178 miles, will be 1.8 cents, and the break-even load to meet direct costs will be 13-14 passengers.

The airline's estimates, which are probably the most accurate assessment of Eland-Convair costs yet published, are printed below. Adjustments have been made to achieved figures in certain cases, as noted, but no allowance has been made for "learning curve" economies or recent and expected increases in engine overhaul life.

	Cents Per Revenue Mile	
Flying Operations		
Pilots' salaries	17.58	(a)
Travel expense	.95	
Fuel	16.61	
Oil	1.00	(b)
Supplies	.06	
Insurance	6.59	(c)
Employee welfare	.88	(a)
Payroll taxes	.25	
Fuel taxes	1.23	(d)
Total	45.15	
Direct Maintenance		
Labour—airframe	6.62	(e)
—engine	.26	
—other	1.11	
Outside repair—airframe	.64	
—engine	18.05	(f)
—other	.20	
Material—airframe	.53	
—engine	.03	
—other	.13	
Reserve for airframe overhaul	2.00	
Total	29.57	
Depreciation	20.64	(g)
Total direct operating costs	95.36	cents

(a) Adjusted to remove pilot's salary charged to the aircraft although illness prevented his flying during the period.

(b) Adjusted to effect a conservatively computed oil cost of 1 cent per revenue-mile. One-plane operation does not provide enough volume for practicality and economy in the use of standard oil-reclaiming processes.

(c) Adjusted to lower rates which became effective on Jan. 1, 1960, and to effect savings under standard U.S. scheduled airline fleet rates.

(d) Adjusted to reflect reduction in Pennsylvania tax, effective Jan. 1, 1960, from 1½ cents to 1 cent per gallon.

(e) Provision for additional airframe maintenance costs under fleet operation of five aircraft instead of one.

(f) Adjusted to basis of engine manufacturer's guarantees under purchase contract and reclassification of maintenance burden to ground and indirect expense.

(g) Straight-line depreciation to 15% residual, computed on 6½ hr. utilization per day at 240 m.p.h. Airframe valuation $612,500, life 120 months; engines, including spare, $356,250, life 60 months; propellers and spares, $75,000, life 120 months.

ICAO and Supersonics

A PRELIMINARY study of the technical, economic and social consequences of the introduction of supersonic aircraft has now been prepared by the ICAO Secretariat and will soon be circulated to all member States. The study was requested by the ICAO annual assembly a year ago, when the deadline for its completion was set at the end of September, 1960. It was considered at the council meeting in Montreal last month, when the need was stressed for international co-operation in determining the operating specifications of commercial supersonic transports.

The ICAO attitude was summed up as follows:

"It is important that between now and the time when supersonic airliners will enter into operation, governments and operators prepare plans and co-ordinate their efforts in order to assure orderly development of international air transport with equality of travelling public, the airlines, and to the planning and implementation of the required ground facilities, and to the economic and social aspects of their operation. All efforts will be well justified if, in the future utilization of aircraft of very much greater performance, the desired result is achieved: further progress in safe, regular and efficient international air navigation and orderly development of international air transport with equality of opportunity for all."

The ICAO Council has also adopted a series of recommendations designed to facilitate air transport and reduce "red tape," and has set up a standing group on implementation of ICAO Air Navigation Regional Plans. This group, which includes the president of the council, president of the air navigation commission and chairmen of the air transport, joint support and finance committees, will "bring ability and experience promptly to bear" where there are serious deficiencies in the implementation of regional plans.

The Air-freight Business

IT is now generally accepted that mechanized loading systems will be essential for all-cargo aircraft with payloads of upwards of 50,000 lb. But the design of these systems is no easy task if weight and cost penalties are to be low enough to make them worth while in normal day-to-day operations as opposed to idealized operations in which 100% loads are assumed to be continuously available.

The aircraft is, after all, only one element in a cargo transport system and super-efficiency may not pay off unless ground-handling conditions are brought up to the same standard. The fact remains that a start has to be made somewhere and it is logical for this start to be made by the aircraft manufacturer and operator. A turn-round time of five hours is just not acceptable—and this is the order of ground delay involved in unloading and reloading a payload of 65,000 lb. by manual methods.

In the Canadair paper referred to in our Jly. 8 issue,* it was explained that initial studies of mechanized systems for the CL-44, assuming the use of rigid pallets riding on roller beds, showed that there was a weight penalty of nearly 10% (or about 6,500 lb.) and a capacity loss, due to the depth of the rollers and pallets alone, of more than 300 cu. ft. These losses were considered to be unacceptable and a new approach—involving lightweight flexible pallets riding on rubbing strips—was tried and has since been shown to be feasible in a full-scale functional test rig. The weight and capacity penalties, using this system and special bins for the main underfloor hold, were reduced to 2,800 lb. and about 70 cu. ft. respectively.

An analysis of hand-loading versus mechanized versions of the CL-44, when used on a U.S. transcontinental operation with

* "Modern Cargo Aircraft Design" by Mr. E. H. Higgins, chief engineer, aircraft, of Canadair, Ltd., at the C.A.I. Annual Meeting.

Air Transport . . . .

PERSIAN INAUGURATION.—This ex-Sabena DC-7C is now seen at London Airport twice a week in the colours of Persian Air Services which, as noted on this page, inaugurated passenger services between Teheran and European cities last month.

unloading and loading at each end and with half the payload changed at one intermediate stop—has shown some fairly startling results. The potential utilization of the mechanized version is 14.88 flight hours in 24.1 hours elapsed time—against 37.1 hours elapsed time for the hand-loaded variant. The direct operating costs work out at $485 per hour for the hand-loaded aircraft and $425 per hour mechanized aircraft—or $429.8 per hour when the cost of depreciation and maintenance of the mechanized equipment, pallets and bins is included.

Assuming indirect costs to be 100% of direct costs, a revenue rate of 12 cents per ton-mile and 100% load factors (with, consequently, a maximum payload advantage in favour of the hand-loaded aircraft) the prospective net profits are in the ratio of 22.3 : 12.3 in favour of the mechanized aircraft.

All this is very theoretical, but it shows very conclusive trends, and the average utilization would need to be extremely low before the hand-loaded aircraft showed any advantage.

B.E.A. Profits and Progress

AS shown by the tabulated traffic results for May, below, B.E.A.'s overall load factor fell despite an 18% increase in passenger traffic. This reduction in load factor—the first since November, 1958—was in fact intentional, since the record levels at which the Corporation operated last year were found to be rather too close to the point where an unacceptable amount of traffic has to be turned away during peak periods. The large increase in capacity provided by the six Comet 4Bs

	May 1960	May 1959	Variation
Capacity ton miles offered	20,854,000	16,885,300	+23.5%
Load ton miles sold	13,783,400	11,591,900	+18.9%
Revenue load factor	66.1%	68.7%	− 3.8%
Passengers carried	345,508	292,389	+18.2%
Passenger miles flown	123,899,000	104,667,000	+18.4%
Passenger load factor	66.6%	70.4%	− 5.4%
Freight ton miles	1,481,700	1,236,200	+19.9%
Mail ton miles	334,800	322,100	+ 3.9%
Aircraft miles flown	3,656,700	3,266,500	+11.9%
Revenue hours flown	17,603	16,662	+ 5.6%

now in service has made it possible to plan load factors a few points lower this year but they are still substantially above the European average.

Accounts for the 1959-60 financial year in which, as already reported, an overall profit of rather more than £2 million was made, show that the seven summer months from April to October were profitable while winter operations were at a loss. Total profit in the summer period was about £5 million, including a million pounds a month in July, August and September.

Two milestones recently passed by B.E.A. were the completion of half a million revenue hours of Viscount flying (on Apl. 18) and the production of 200 million capacity ton-miles in a year.

Persian Air Services

ON Jne. 20, Persian Air Services became the fifth operator to offer through service between London and Teheran, with the inauguration of its first passenger flights. Having operated scheduled freight services between Persia and Europe for the past six years or so with DC-4s and a DC-6, the company has now obtained a DC-7C from Sabena, with which it is associated. Sabena provides the flight and cabin crews and the company bases its operations on Brussels, where Sabena maintenance facilities are available.

A non-IATA carrier, Persian Air Services is nevertheless charging IATA rates on its flights which serve London, Brussels and Geneva twice a week and Paris once a week. An attempt has been made to provide above-standard accommodation and cabin service; the first-class section has 12 de luxe seats (and four sleeperettes at supplementary fares) and the tourist section has 35 widely spaced reclining seats. The flights are timed to give a late afternoon or evening departure from Europe and early morning arrival in Teheran.

In Teheran, the services connect with Iranair flights to other points in the Gulf. The two companies operate in close collaboration and there is a possibility that a complete merger will be effected. Jet equipment may be purchased soon to place Persian Air Services on a more competitive basis with other operators on the route, including B.O.A.C., Qantas, P.I.A. and Pan American out of London.

The P.A.S. freight services, continuing with DC-4s, operate between Brussels and Teheran and serve Abadan, Damascus, Beirut, Athens and Basle. In addition, a maximum of 5,000 kg. of freight can be carried on the DC-7C in a forward hold in the cabin and in the under-floor freight holds.

A London office is shortly to be opened by P.A.S. at No. 1 Grafton Street, W.1, where Mr. K. F. Lyons will continue as U.K. commercial manager. The director of operations for Europe is Mr. Goossens, with an office in Brussels. The company's president is His Excellency Ahmed Chafik.

Boeing Accident Report

NOW that the C.A.B. has issued its report on the accident to a Boeing 707-227 last October, it may be useful to summarize the sequence of events. The accident, involving one of five 227s ordered by Braniff Airways, occurred on a demonstration and acceptance flight prior to the aircraft being delivered. Of the eight occupants, four were killed. The C.A.B. report describes the events leading up to the accident as follows:—

"The instructor-pilot initiated a Dutch roll in which the roll-bank angle of the aircraft reached 40 to 60 deg. This bank angle is in excess of limitations set by the company for demonstration of this manœuvre. The pilot-trainee, who was to make the recovery, rolled full right aileron control while the right bank was still increasing. The aircraft immediately yawed and rolled violently to the right. The instructor-pilot immediately rolled in full opposite aileron. The airplane stopped its right roll at a point well past a vertical bank and then rolled to the left even more violently.

"Several gyrations followed and after control of the aircraft was regained, it was determined that three of the four engines had separated from the aircraft and it was on fire. The fire rapidly reduced controllability of the aircraft and an emergency landing was attempted; however, the aircraft struck trees and crashed short of the intended landing area because power on the engine remaining had to be shut down to keep the aircraft wings level."

The Boeing training manual restricts the Dutch roll manœuvre to a desired maximum roll-bank angle of 15 degrees and an absolute maximum of 25 degrees. Several Dutch rolls had been demonstrated by the Boeing instructor-pilot and practised by the Braniff pilot-trainee, who was making his first flight in the 707. A further series of recoveries was then made with the aircraft flaps lowered to 40 degrees. Up to this time, all the recoveries had been made from the left. The Boeing pilot then suggested a recovery be made from the right, and initiated Dutch roll in which the angle of bank was, according to survivors' estimates, 40-60 degrees.

When the pilot-trainee initiated recovery, as noted above, right bank was still increasing and the aircraft immediately yawed heavily to the right and rolled rapidly to the right, well beyond a 90-degree bank. The Boeing pilot immediately took control and remained in command up to the time of the crash.

The Development of Air Transport in Italy—1

New Airports in Italy

by T. D. Calnan

THE current development of air transport in Italy, involving as it does a considerable capital expenditure, is not a subject which can be examined entirely in isolation. To put it in perspective, it should be viewed against the background of Italy's expanding economy and growing industrial strength. Nor is it easy, in a few sentences, to draw the outlines of this background.

Italy, it is true, has many hundreds of thousands of very poor people and extensive depressed areas. But it would be a mistake to conclude from this premise that Italy is a poor country. On the contrary, Italy has money to spend and formidable sums are being invested in the development of the economy. Put all too simply, Italy consists of a rich, highly industrialized north and a very poor agricultural south. The industrial north can and does carry the south, perhaps reluctantly. A deliberate economic policy of investing the wealth earned by the north to create an economic infrastructure in the south and to create there centres of employment, where none existed, is slowly gathering momentum and beginning to take local effect.

In the north, the industries are booming. Fiat, for instance, manufactured a total of 430,282 automobiles in 1959. In nearly all fields, with the particular exception of the aircraft industry, statistics show new peaks of production and profit, and there is a noticeable atmosphere of buoyancy and confidence in the future. There has been a steep increase in foreign investment and it is particularly significant that more and more U.S. industries are recognizing the advantages of having a foothold inside the tariff wall of the European Common Market, in a country where labour costs are low.

Twenty Million Tourists

There is one industry, however, by far Italy's biggest, which is not localized in the north, but pervades the whole country and provides more employment and is the source of more wealth than any other. This is the tourist industry, now one of the cornerstones of the Italian economy. Last year the fantastic number of 16,780,136 foreigners spent their holiday money in Italy. This year, with the Olympic Games taking place in Rome, it will not be a surprise if the total reaches 20 million.

It is revealing and a little sobering to analyse the means of transport used by these tourists to travel to Italy. Top of the poll are the 12 million motorists who spent over £8,000,000 on petrol coupons before even setting foot in the country. The railways come second with four million tourists and air transport a very poor third with 559,314, representing a little over 3% of the total.

In the light of these figures it is not surprising that immense sums of money are being spent to make the motorists' holiday in Italy more enjoyable. What is surprising is how much is being invested in air transport, given that the revenue derived from air-transported tourists is, probably, hardly a twentieth of that accruing from the motorists.

To have a yardstick for comparison, it is worth while looking at the expenditure on roads in a little detail. The most outstanding single item is the Autostrada del Sole which, in 1963, will connect Milan with Naples, a distance of 550 miles. This is a project costing over £100,000,000 and puts the M1 in its place. The first section from Milan to Bologna was opened last December and is 130 miles of the ultimate perfection in fast, safe motor routes. All the wants of the motorists are catered for at regular intervals along its length. The Pavesi Restaurant, for instance, which is housed in a glass and steel bridge spanning the autostrada at Fiorenzuola, has been expressly designed for the motorist and has no rival in Europe. I recommend it to Mr. Marples when he takes his next bicycle tour through Italy.

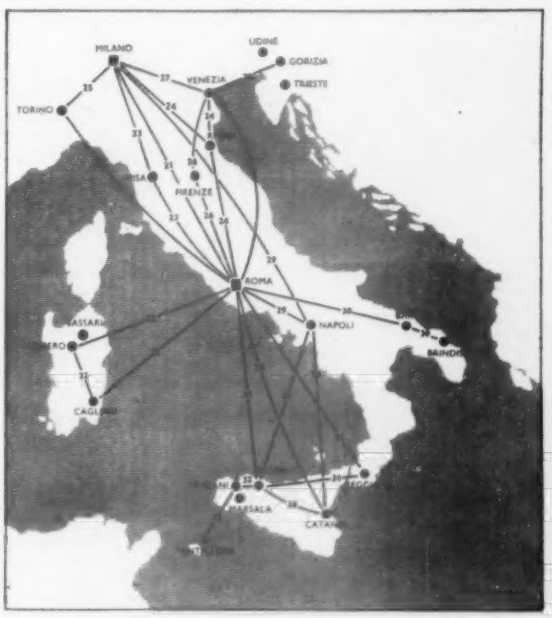
There is no example as spectacular as this in the field of air transport. Nevertheless, the cost of the programme in hand to improve the basic infrastructure of air transport in Italy, presents an impressive total. At the beginning of the year, work was in progress on no less than 20 airfields, involving a total expenditure of over £50,000,000. Included in this programme are projects for five entirely new major airports at Fiumicino, Genoa, Palermo, Venice and Trieste.

The biggest and most ambitious of these five projects is Rome's new intercontinental airport at Fiumicino. £15,000,000 has already been spent on the building of the airport and the final total cost will be something over £18,000,000. The latest news of progress towards final completion is disappointing. In spite of the determination of all concerned to have Fiumicino fully operational before the Olympic Games in August, it is now unlikely that this wish will be realized. In part, this is due to the long, drawn-out political crisis, which left Italy without a Government for over two months. The money voted for the project was exhausted earlier in the year and a supplementary £3,000,000 asked for. Because there was no Government in being, it was very difficult to find the extra funds.

As an airfield it now offers perfectly adequate facilities. But it is by no means ready to handle passengers or to take over the traffic at present handled by Ciampino. The air terminal has not yet been furnished and accommodation for the airline operators is not yet ready. At best, it looks as if Fiumicino will be partially in use before the start of the Olympic Games, with the airline operators working under difficult circumstances and passengers having to put up with makeshift arrangements.

At long last Genoa is to have an airport. This will fill a gap in the amenities of Italy's largest port which has existed for too long. Although of modest dimensions, with one runway of 2,285 metres (7,500 ft.) the project is costing £12,000,000. This is because Genoa had a particularly difficult problem to solve. The terrain in the region of the city just does not offer any sites suitable for an airport. Genoa, therefore, chose the expensive alternative of building its airport in the sea. An artificial peninsula is being constructed a little to the north of the main port area, which will be the site of the new airport. Recently, some 3,000 ft. of runway on this ever-growing peninsula has been opened to traffic. As a result, Genoa now has an air connection with Rome, for the first time. This is provided by ITAVIA, one of Italy's very few independent operators, who now provide a twice-daily Rome-Genoa service with D.H. Herons.

At Palermo, Sicily's capital, a new airport is being built at Punta Raisi. The mere mention of the name Punta Raisi in aeronautical circles is enough, at present, to start a fight. It is the centre of some very bitter criticism from the aeronautical



ITALIAN NETWORK.—This map shows the domestic routes of Alitalia. The numbers refer to routes and have no significance here.

Press. Previously, Palermo has been served by the airfield at Boccadifalco, some four miles west of the city. This field had only a 1,250 m. (4,100 ft.) runway and featured only on Alitalia's internal schedules. It could expect no direct influx of airborne tourists, except for the occasional chartered Viking or DC-3. This state of affairs was not at all to Palermo's liking. Sicily is trying hard to attract tourists and has realized that the undoubted attractions of the island are not enough if the island be not accessible. It was therefore, determined by the Comune of Palermo that the city should have a modern airport capable of accepting the most modern of airliners. Thus the main runway at Punta Raisi is to have a length of 3,000 m. (9,840 ft.).

The sudden storm of criticism which is embarrassing the Directorate General of Civil Aviation, would appear to be based on solid foundations. The airport is being constructed on a small flat area at the seaward end of a mountainous promontory. Both main and secondary runways are parallel, 70°/250°, and have the sea at each end. Immediately to the south of the runways is a 3,000-ft. mountain. The whole promontory of Punta Raisi is an area of strong winds which, so the critics claim, frequently do not blow up and down the runways. The proximity of the mountain does not make for calm conditions on the approach. During the winter months, the secondary runway has been used for regular Alitalia services. On a small number of occasions the cross-wind component has been too high to permit landing at Punta Raisi.

This is the main basis for criticism. Coupled with the argument that Palermo does not need a 3,000 metre runway and with the fact that the airport is 25 miles from the city of Palermo, the critics have frightened the authorities into appointing a special commission to inquire into the suitability of the site. But the Sicilians are an independent-minded race, who do not take kindly to interference from the mainland. As Sicily has contributed 40% of the cost of the project, it is very probable that Palermo will have its new airport, even if the runways are occasionally out of wind.

Expansion at Venice

The fourth new airport is being constructed at Venice, which is at present poorly served by Alitalia's DC-3s using the grass strip of 1,000 metres at Venice Lido, on an island in the lagoon. The new airport will be on the mainland and have a main runway length of 2,400 m. (7,872 ft.). It will be fully equipped as a modern international airport to cater for the European tourist trade. It is also probable that the airfield at Venice Lido will be provided with 1,200 metres of concrete.

The fifth new airport on the list is at Trieste. The plan for modernizing Ronchi dei Legionari and building a 3,000 m. (9,850 ft.) runway has been approved.

Milan, the industrial capital of Italy, also figures prominently in the programme. The Milanese, with some justification, consider that their own city is the most important in Italy and that Rome is an anachronism, no more than the seat of government, when there is one, and a popular tourist centre. Thus Milan had to match Rome's new airport at Fiumicino. Although Malpensa will not, in fact, be nearly as impressive as Fiumicino when the latter is complete, nevertheless, the Milanese have beaten the Romans to the tape and their extended airport, with a main runway of 3,900 m. (12,792 ft.) and a new second runway of 8,500 ft. is now ready to accept and dispatch traffic to and from any destination in the World.

Malpensa, however, is 30 miles from the city of Milan. It has therefore been decided to provide the city with a second airport, less than four miles from the centre of Milan, which could be used for internal and European airlines. Milan-Forlanini has thus been completely remodernized with a new runway of 2,200 m. (7,216 ft.) and all essential aids. The airport is ready for use. Domestic trouble is, however, holding up the transfer of Alitalia's internal services from Malpensa to Forlanini.

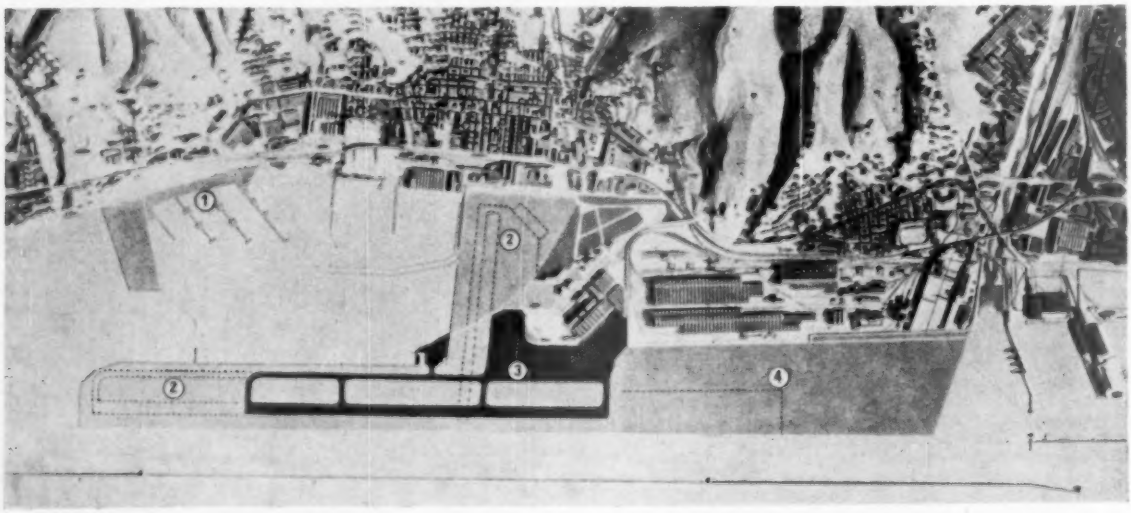
Both Forlanini and Malpensa were reconstructed by private enterprise, by a concern named Societa Esercizi Aeroportuali, who also administer both airports. This society established landing fees for Forlanini which they expected Alitalia to pay. Alitalia, on the other hand, enjoy the privilege of greatly reduced fees at all airports in Italy and have refused to pay S.E.A.'s charges. The result is deadlock. Alitalia continue to land Milan-bound passengers at Malpensa, although there is an airport available 26 miles closer to the city of Milan. This is entirely typical of the kind of difficulty which obstructs progress in this happy country. And always, the battle between private enterprise and the State is the most bitter.

And so the list continues. Turin, anxious to appear on international airline schedules, is extending its main runway to 3,000 m. (9,840 ft.). Albenga, Alghero, Bari, Brindisi, Cagliari, Catania, Florence, Forli, Pescara, Pisa, Siena, Treviso —at all these airfields work is in progress either to extend runways or build air terminals or, in some necessary way, to renovate the airfield and bring it up to modern requirements.

Whether all this is money well spent is a question being asked with some insistence by the aeronautical Press. The point being made with emphasis is that Italy is too small a country to need five airports with runways of 3,000 metres or over. The argument is that, given an intercontinental airport at Fiumicino and accepting a second at Milan, because it is difficult to refuse Milan anything it considers necessary, all that is further required is a frequent and efficient network of internal services operating from airports of modest dimensions, i.e., 2,000-metre runways. This, it is claimed, would be a satisfactory, and far less costly, method of solving Italy's air transport problems. This, however, is an argument which completely fails to impress those cities building airports on a more ambitious scale who feel that theirs is the best way to attract tourists directly to their doorsteps.

Whatever the arguments, nothing can alter the fact that the concrete is being laid and that all these projects are fast advancing towards completion. Nor is it likely that Italy will be the loser by this investment. Even with a series of new autostrada, saturation point on Italy's roads is not very far away. On the other hand, the figure of a mere half-million air-transported tourists is one which offers the possibility of a considerable and very profitable expansion.

(To be continued.)



SPACE FROM THE SEA.—How Genoa plans to provide modern airport facilities close to the city centre. (1) New fuel quays; (2) Projected runway extensions; (3) Work in hand; (4) Factory extension area.

The Fighting Services

C.F.S.A. Reunion

THE Central Flying School Association held its 48th Anniversary Reunion Dinner in the Officers' Mess at Little Rissington on Jly. 8. The president on this occasion was Air Marshal Sir Richard L. R. Atcherley, K.B.E., C.B., A.F.C., and the guest of honour was the C.A.S., Air Chief Marshal Sir Thomas G. Pike, K.C.B., C.B.E., D.F.C. Among those present were Sir Maurice Dean, K.C.B., K.C.M.G., Permanent Under-Secretary of State for Air; Air Chief Marshal Sir Theodore N. McEvoy, K.C.B., C.B.E., A.D.C., the Air Secretary; Air Chief Marshal Sir W. Alec Coryton, K.C.B., K.B.E., M.V.O., D.F.C.; Air Vice-Marshal G. A. Walker, C.B., C.B.E., D.S.O., D.F.C., A.F.C.; Air Commodore I. G. Morrison, C.B.E., of the R.N.Z.A.F.; and Gp. Capt. Panieng Kantarat, Thai Air Attaché.

In his after-dinner speech the C.A.S. stressed the need for manned aircraft in the R.A.F. for many years to come. Fighters would be necessary to prevent enemy aircraft flying across this country at will. Bomber aircraft would continue in service, whilst the need for coastal and transport aircraft was quite obvious.

Air Cdre. J. N. H. Whitworth, C.B., D.S.O., D.F.C., the Commandant, reviewed the activities of the C.F.S. during the past year, and told of the high regard in which it is held in the many countries he and his staff had visited.

A magnificent model B.E.2 was presented to C.F.S. by Air Vice-Marshal Sir Willett A. B. Bowen-Buscarlet, K.B.E., C.B., D.F.C., D.L., on behalf of Sir Geoffrey de Havilland. This model was originally presented to the late Commodore G. M. Payne, C.B., M.V.O., R.N. (who was first Commandant of C.F.S.) by the officers of C.F.S.

Air Commodore I. G. Morrison presented the Commandant with a plaque bearing the crest of the R.N.Z.A.F. Central Flying School, Wigram. And the Commandant presented Gp. Capt. Panieng Kantarat with a C.F.S. crest.

Air Rank Appointments

AIR VICE-MARSHAL H. B. WRIGLEY, C.B.E., who until recently was at the Ministry of Aviation, has been appointed Senior Technical Staff Officer at Headquarters, Fighter Command. He became Chief Signals Officer of 2nd T.A.F. in Germany in 1952 and in June, 1954, was appointed Director of Signals (1) at the Air Ministry.

Air Cdre. E. L. G. Le Dieu, C.B.E., Director of Personnel Services (B) at the Air Ministry, is to become Air Commodore in charge of Organization at Headquarters, Maintenance Command. Since he joined the R.A.F. in 1927, Air Cdre. Le Dieu has specialized in accountancy, his last appointment in this field being in 1954 as Deputy Director of Financial Services at Headquarters, Allied Forces Central Europe, at Fontainbleau.

Anglo-French Exchange

PART of No. 72 Squadron (Wg. Cdr. R. E. Gardner, D.F.C. and bar) is visiting Tours in France on an exchange basis with part of the French Air Force's 30e Escadre de Chasse Tous-Temps (Capitaine Berg) which is visiting Leconfield. This exchange of all-weather units is part of the routine training programme adopted for the air forces of NATO countries. During the visit in each case normal squadron flying will be followed with the British and French aircraft operating as one unit.

No. 72 Squadron has Javelin F(AW) Mks. 4 and 5. The French squadron is equipped with Sud-Aviation Vautour II-Ns and their visit will be the first time that these aircraft will have been seen in this country—except for those participating in last year's London-Paris air race. The Vautour is powered by two 7,700-lb.s.t. Atar turbojets and is supersonic in a shallow dive. The all-weather version is armed with four 30-mm. DEFA guns in the nose and has automatic search and tracking fire control radar.

New Director of Manning

FROM July 25, Gp. Capt. F. J. Manning, C.B., C.B.E., becomes Director of Manning (2) at the Air Ministry with the acting rank of Air Commodore. He has been on the staff of the Air Ministry's manning branch since 1959.

Gp. Capt. Manning started his Service career with the Royal Navy and joined the R.A.F. in 1933. After a spell at Mount Batten on R.A.F. marine craft, he joined No. 269 Squadron on flying duties. In 1939 he went to the operations staff of No. 201 Group in the Mediterranean and at the end of 1940 joined the Headquarters staff of Coastal Command. From 1942, for four years he was in the department of the Director of Organization at the Air Ministry, after which he again served in the Middle East.

He went to Halton on engineering duties in 1948, was later appointed Deputy Director of Allied and Foreign Liaison at the Air Ministry, and subsequently spent three years with the British Service Mission to Burma. In 1956 he became Deputy Director of Works Study—a post he held for three years.

Battle of Britain Air Shows

AT Fighter Command Headquarters, a small specialist staff is planning the detailed arrangements for the R.A.F.'s "flying circus" that will tour the U.K. on Sept. 17 to give displays at the various R.A.F. stations "at home" for the Battle of Britain commemoration. Twenty-five stations will, in fact, be open to the public and something like 125 aircraft will be involved in the visiting displays.

Every type of aircraft operated by the R.A.F. is said to be taking part in these flying displays. They will include the renowned 111 Squadron and will be supplemented by the U.S.A.F.'s aerobatic Skyblazers team. Fighter Command is also acting as a collecting agency for other Commands' aircraft. Some 150 aircraft have been allocated to form static displays and a further 150 will be standing by to give flying displays when called upon by station organizers.

At Biggin Hill—centre of the Battle of Britain celebrations—the U.K. Air Traffic Control Services and the Ministry of Aviation are collaborating to reserve an airshow airspace in the area 12 miles long and 6 miles wide. Civil aircraft on the approach to London Airport will be diverted to keep the area clear.

"Life in the R.A.F."

TONIGHT, Jly. 22, B.B.C. Television is presenting the first of six weekly programmes on "Life in the R.A.F." The object of this series is similar to that of the series recently shown in "Blue Peter" on "Life in the Royal Navy," and will introduce typical members of the Service to explain their respective jobs. All these programmes will feature film specially provided by the R.A.F.; the first three will illustrate life in Fighter Command and the last three, life in Bomber Command.

The first programme will explain the task of a fighter pilot, when the speaker will be Sqn. Ldr. Peter Latham, A.F.C., of No. 111 Squadron. On Jly. 29, Cpl. Green, also of Treble One, will describe the work of an engine fitter. Radar control will be the subject of the third programme. Flt. Lt. F. Hines will explain the rôle of a V-bomber pilot on Aug. 12. Ch. Tech. P. H. Huggins, a crew chief, will speak about V-bomber maintenance on Aug. 19; and Cpl. Tiller, W.R.A.F., will describe her work in maintaining radio contact with a V-bomber in the last programme on Aug. 26.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. T. S. Kennedy, O.B.E., to the Department of the Air Member for Supply and Organization; Wg. Cdr. G. W. Bennington, D.F.M., Wg. Cdr. C. G. Maughan and Wg. Cdr. M. C. S. Shepherd, O.B.E., to the Department of the Chief of the Air Staff.

Bomber Command: Gp. Capt. R. S. Radley, D.F.C., A.F.C., to R.A.F. Hemswell, to command.

Coastal Command: Wg. Cdr. R. D. Roe to R.A.F. Ballykelly, to command No. 204 Squadron.

Transport Command: Gp. Capt. W. J. McLean, D.S.O., D.F.C., A.F.C., to Headquarters as Gp. Capt, Training.

Flying Training Command: Wg. Cdr. P. L. Arnott, D.F.C., to R.A.F. Cranwell, to command the Administrative Wing.

Technical Training Command: Wg. Cdr. J. B. Evans, O.B.E., to Headquarters, to command the Trade Standards Section with acting rank of Gp. Capt.; Wg. Cdr. H. Ball to No. 2 School of Technical Training, Gosford, as Senior Training Officer.

Maintenance Command: Sqn. Ldr. S. Kirtley to No. 33 Maintenance Unit, Lyneham, to command, with acting rank of Wg. Cdr.

Far East Air Force: Wg. Cdr. A. R. Wright, D.F.C., A.F.C., to Headquarters as Gp. Capt. Plans, with acting rank of Gp. Capt.; Wg. Cdr. J. J. Dennis, O.B.E., to Headquarters for radio duties; Wg. Cdr. W. T. Ellis, A.F.C., to R.A.F. Tengah, to command the Administrative Wing; Wg. Cdr. I. D. H. Gibbins, M.B.E., to R.A.F. Changi, to command the Technical Wing; Sqn. Ldr. R. C. Chamberlain as Command Catering Officer, with acting rank of Wg. Cdr.

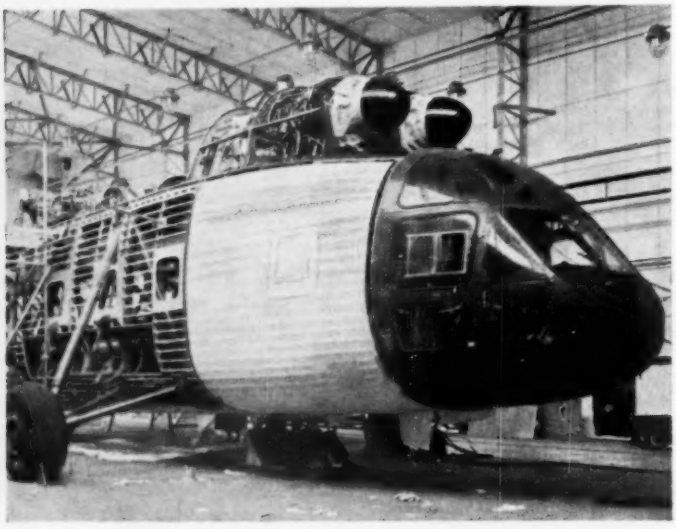
Other Appointments: Wg. Cdr. N. S. Fear to the British Joint Services Mission, Washington, as Senior Officer in charge of Administration; Wg. Cdr. A. Fry, O.B.E., to Ministry of Aviation.

Westland's New-look Westminster

A FURTHER step in the general development of large transport helicopters was made by Westland Aircraft recently when the company reached the beginning of another phase in its Westminster research programme. The first prototype, G-APLE, has now been made more aerodynamically representative of the original project for a civil transport helicopter. In fact it has been given a faired fuselage around its hitherto "unclothed" tubular airframe.

This interesting version is purely and simply a flying test rig and is not intended for practical operational application. It made its debut at the R.N.A.S. Air Day at Yeovilton on Jne. 13—the day after its maiden flight—and the first photograph of it appeared in our issue for Jne. 24.

A decision to go ahead on this particular project was taken last year when the then current airline investigations of such helicopters as the Vertol 107 and Sikorsky S-61 aroused further interest in the Westminster transport project. By virtue of its size and performance this had always been a very promising possibility as a "second-generation" type for airline use. And as an extensive test programme to establish the general stability and handling characteristics with the "crane"-type prototype had been completed, it was logical that the next step should be some aerodynamic investigations with a more representative shape.



One of the 10-ft. sections of the Westminster's faired fuselage with the fabric covering attached. Note the structural gap between the front frame and the nose portion.

It will be remembered that both the Westminster prototypes had been given the correct front fuselage. To achieve the object in mind for the next stage, all that needed to be done was to clothe the remainder of the structure with a false fuselage aft of the nose portion back to the tail.

For the sound practical reasons of economy and time-saving a fabric covering on wooden frames was chosen and this has proved most successful for the purpose envisaged. At the particular stage of development at which this was decided, it was not possible—nor was it particularly desirable anyway—to reproduce the civil Westminster shape with any exactitude. For example, the use of a Sikorsky S-56 rear rotor pylon and the incorporation of external fuel tanks were two features in which the prototype configuration differed fundamentally from the initial project. Nevertheless, the result is a fairly close approximation and quite good enough to provide the sort of qualitative data wanted; it is also capable of giving a certain amount of quantitative data.

No great technical problems have been posed in the transformation. Light plywood frames are used to give the required cross-sectional shape and the fabric is supported on a large number of closely spaced stringers. Because the basic tubular structure is much narrower than the required faired shape, comparatively shallow frames are used and supported from the tubular structure by means of large horizontal ply gussets. This avoids having deep frames which would tend to be unstable unless made bulky and, therefore, heavy.

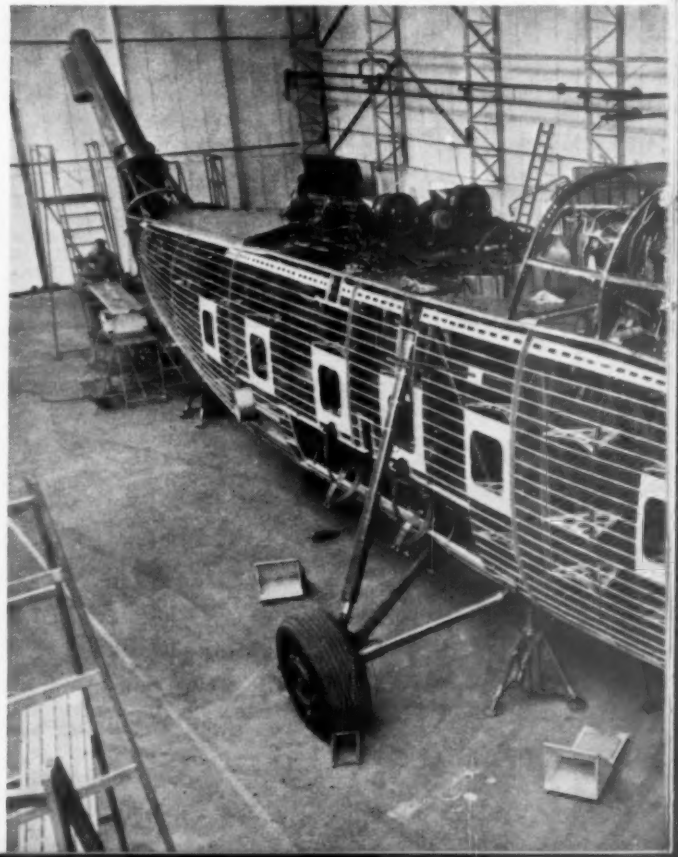
The frames are notched to take the continuous stringers which, it is interesting to note, are similar to those used in the Lysander. They have a T cross-section with a domed flange to support the fabric.

The fuselage roof is a metal structure right back to the tail and is identical to that already incorporated in the open-framework airframe of the second prototype. Doors and access panels and the extreme rear end of the fuselage, where it is faired into the tail rotor pylon, are also of metal construction.

Although this form of fuselage structure is basically the same as that used many years ago, it can be said to represent a much more advanced type. Indeed, one particular problem was found which is of a later aeronautical generation altogether. The usual combination of madapollam and cellulose dope was found to be adversely affected by the synthetic lubricating oils now used in gas-turbine powerplants. There was a tendency for the fabric to deteriorate and for the dope to lift. This somewhat serious problem was overcome by using Terylene fabric and a liquid nylon "dope." The result is extremely satisfactory—both from the point of view of appearance and practicability.

An interesting feature of the outer fuselage is that it is built in 10-ft. sections. At the ends of these sections is a double frame with a small gap unbridged by stringers and simply faired over by a fabric strip. This "broken" structure has been adopted as a means of avoiding end loads being taken by the wooden stringers.

One noticeable change in overall configuration has been the



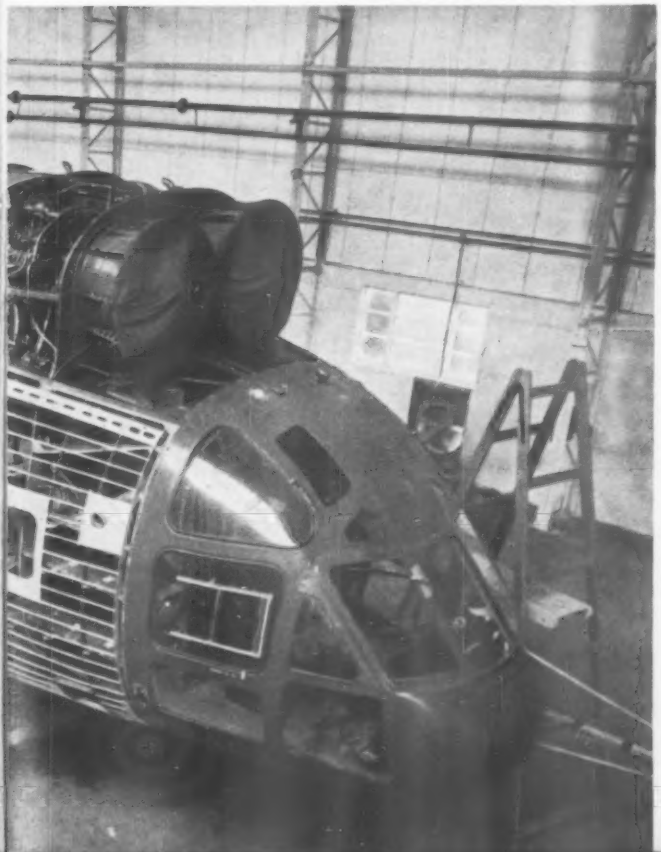
Closely spaced stringers on plywood frames give the fuselage a remarkably smooth contour which has succeeded in making the Westminster look much bigger.

Although the faired fuselage is not an exact replica of the originally projected shape it is a close enough approximation to give some useful aerodynamic data.

addition of a low-set tailplane under the rear fuselage. This has been made necessary by the inherent destabilizing influence —in pitch—of a cleanly faired fuselage. This unit is a pure stabilizer and has no controlled incidence-change system, although it is adjustable on the ground.

This "new-look" Westminster flying test-rig has already demonstrated that it can cruise at 130 knots—which, interestingly enough, was the design cruising speed for the original civil Westminster project. And the excellent handling and control and stability characteristics of the unfaired prototype, so convincingly demonstrated at the S.B.A.C. Show last year, have remained unimpaired by the drastic change in shape.

The shallow plywood frames are supported from the tubular structure by means of large triangular plywood gussets.



At present this machine is having its standard S-56 five-bladed rotor replaced by an experimental Sikorsky six-bladed one. The Westland team are to make a complete performance assessment of this unit and compare it with the five-blader. This work is, in fact, being done by agreement with Sikorsky and has no particular reference to the faired Westminster as such. Clearly, however, such developments are all closely related and the results of this survey could obviously have a bearing on future Westminster developments.

Preliminary work done by Sikorsky in America with the six-bladed rotor on the S-56 showed an increase of as much as 15 knots in cruising speed. There is no reason to suppose that this order of performance improvement will not be found with the Westminster. If this is the case, its cruising speed might well be around 145 knots (which is higher than the present World's speed record for helicopters).

For an experimental fabric-covered airframe and the largest helicopter outside Russia, this would seem to be a very creditable achievement. There is no suggestion that a record attempt should be made—for obvious reasons this would be impracticable with such a prototype. Nevertheless, the Westland team have good cause to be satisfied with the promise shown by their latest development of the Westminster programme. It should provide a good deal of invaluable information for the development of this type in particular and large helicopters generally.

America's Pacific Missile Range—2

Last week we dealt with the distribution of the Range, its launching sites, and the ships and aircraft that support its operation. The present article describes the extensive tracking and telemetering facilities.

OUTSIDE electronic interference can play havoc with the complex and extensive instrumentation used in missiles and artificial satellites. One recalls the classic case of radio signals associated with a radio-taxi service setting off the "destruct" system of a missile launched from Cape Canaveral. Protecting the radio frequencies from garbling interference, or worse—unauthorized control—can produce the difference between a successful launching and one that fails partially or entirely.

One of the prime tasks of Pacific Missile Range personnel at the Naval Missile Center, Point Mugu, has been to devise a foolproof system of telemetry, radar tracking, and remote control in an area where constant use is made of telemetering and radar frequencies. In South California, for example, between the PMR's launching complex at Point Arguello and the Mexican border, there are several hundred long- and short-range radars scanning the skies on no fewer than 100 radar channels. In telemetry, more than 200 customers use the 44 frequencies set aside for the transmission of data.

However, missile and satellite launching and tracking complexes are by no means the only users of telemetry circuits. Eight major aircraft manufacturers and their associated sub-contractors in Southern California also depend on remotely relayed data to determine the performance of various components during test-flights. Weather forecasting services for farmers, fishermen, businessmen, private aircraft operators, scheduled airlines, the Armed Forces, geologists, and even model aircraft and boat enthusiasts, all use radio communication circuits, thus placing a heavy load on the available frequencies.

To deal with this situation, the Pacific Missile Range has about 50 Servicemen and civilians on constant duty for the

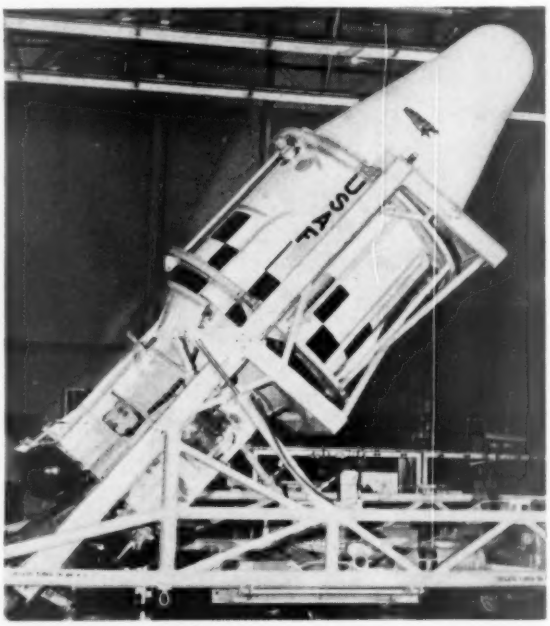
The IBM 709 automatic computer at Pacific Missile Range headquarters, Point Mugu.

express purpose of locating and identifying sources of possible radio interference. They operate at fixed ground stations, from mobile vans and specially equipped WV-2 aircraft (THE AEROPLANE AND ASTRONAUTICS, Jly. 15, 1960, p. 89).

This section—known as Frequency Interference Control—constantly monitors the air waves and conducts density studies of all portions of the radio frequency spectrum. It is virtually impossible for any unauthorized transmitter to come on the air in this area without its knowledge.

Principal monitoring and interference control facilities are situated at Point Arguello, San Nicolas Island, and Point Mugu. The WV-2s are employed for endurance patrols in the PMR's area of responsibility extending far into the Pacific Ocean.

A battery of "hot line" telephones connects the Frequency Interference control officer with Edwards Air Force Base, the Naval Ordnance Test Center, China Lake, Vandenberg Air Force Base, and others. He has direct communication with most



Close-up of a Lockheed Agena satellite of the Discoverer programme. Note the re-entry capsule in the nose, intended to eject on the 17th orbit over the North Pole and be recovered in an area 150 miles long and 50 miles wide near Hawaii.

agencies in this area and a few words on the telephone are usually all that is needed to clear a particular channel or otherwise establish favourable conditions for a test launching.

Tracking Services

More than 35 tracking radars are available to support missile and satellite operations in the Pacific Missile Range. Ten of these are the AN/FPS-16 type, providing an accuracy of five yards at ranges up to 200 miles. One such radar, modified for 500 miles range is located at Tranquillion Peak, Point Arguello. Four AN/FPS-16 radars are installed at the Naval Missile

PROGRAMMES AT THE PACIFIC MISSILE RANGE

Programme	Agency	Type	Launch site	Date
THOR	SAC	IRBM	VAFB	1959–61
ATLAS	SAC	ICBM	VAFB	1959–64
DISCOVERER	BMD	Polar Orbit Satellite	VAFB	1959–64
TERRIER/HAWK	USMC	Air Defence	NMFPA	1958–
H.A.S. (High Altitude Sampler)	AEC	High Altitude Research	NMFPA	1960–
SUNFLARE	NRL	High Altitude Research	NMFPA	1960–
Future Programmes				
TITAN	SAC	ICBM	VAFB	1960–64
MIDAS (Missile Detection Alarm System)	BMD	Polar Orbit Satellite	NMFPA	1960–
SAMOS (TV-Surveillance)	BMD	Polar Orbit Satellite	NMFPA	1960–
NERV (Nuclear Emulsion Recoverable Vehicle)	NASA	Upper Atmosphere Research	NMFPA	1960
MERCURY	NASA	Man in Orbit	AMR (Tracking only)	

Key: VAFB=Vandenberg Air Force Base; NMFPA=Naval Missile Facility, Point Arguello; AMR=Atlantic Missile Range.

Center, Point Mugu, and four at San Nicolas Island. This equipment permits tracking of missiles and target aircraft on two simultaneous air-to-air operations. Two FRS-16s are also located on Tranquillion Peak and are also equipped for long range ballistic and space-vehicle tracking as well as Sea Test Range Operations.

Other types of radar are established elsewhere in the vast Pacific Range area. For example, there are two mobile "S" band automatic tracking radars at Kaneohe in Hawaii. These are used primarily for tracking larger missiles and for air-to-air missile operations.

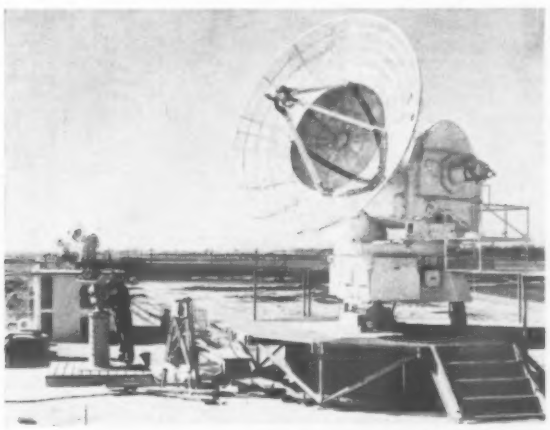
Telemetry

An important part of any test missile or satellite is the telemetering system which signals information from the vehicle to ground recording stations. Telemetry data can be received at any location within the Pacific Missile Range by means of permanent installations at Point Mugu, San Nicolas Island, Point Arguello and Hawaii, the two telemetry ships, mobile vans and an aircraft equipped with a telemetry receiver and recorder.

Two basic telemetry systems are employed: frequency modulation and pulse duration modulation. The former is a frequency division multiplex system—a radio frequency carrier which is modified by a group of subcarriers, each of a different frequency. The subcarriers may be modulated by a time division multiplex scheme in order to increase the number of individual channels.

The second method—pulse duration modulation—is the conversion of data voltages into a pulse formation. The width or duration of the pulse corresponds to the magnitude of data voltage. Data voltages are sampled in a specific order with certain non-data pulses generated for identification and synchronization.

Examples of the type of information transmitted from a missile are temperature, pressure, force, acceleration and velocity. Any of these may be monitored continuously or sampled a specific number of times per second. In missiles, from which a great deal of information is required, it is possible to sample as many as 90 different items every 10 seconds. This information is measured by transducers within the missile. It is possible to sample 86 transducers 20 times every second; 12 transducers can be monitored continuously. Sampled information is transmitted to telemetering receivers which remove the main transmitting carrier and forward the

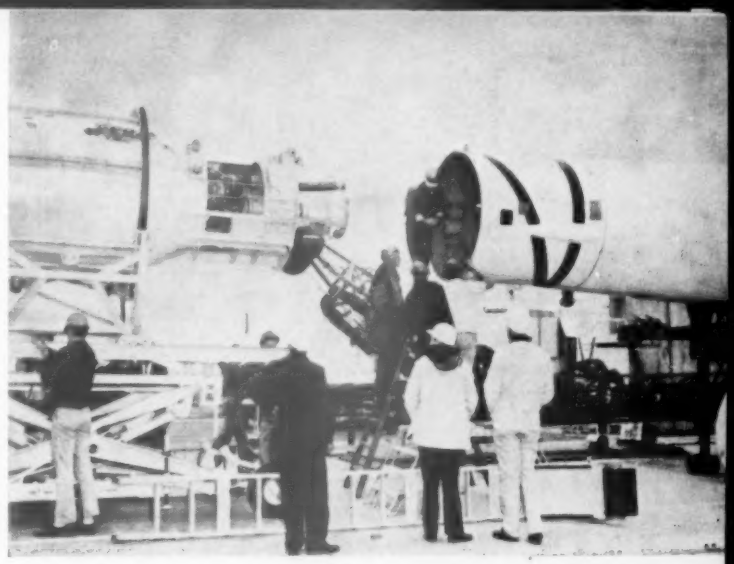


An AN/FPS-16 radar installation at Point Mugu.

remaining parts of the signal for data processing. The processing centre at Point Mugu operates from magnetic tape data input and employs both analogue and digital techniques. Data processing includes editing and extracting essential information from magnetic tape storage and recording this data in analogue form on various recording media. It also includes converting translated telemetering data to a digital format suitable for further processing in an electronic computer.

Receiving antennae with high gain are used to provide telemetry coverage for the Pacific Missile Range. Among aerials in use are multi-helicals erected on servo-controlled mountings. The antenna beam width of about 20° permits manual tracking from knowledge of the missile's planned course for most operations.

For automatic tracking, the PMR operates a high-gain receiving antenna at San Nicolas Island in the form of a 60-ft. diameter parabolic reflector. This is similar to the TLM-18 antennae developed for the Atlantic Missile Range and conical scanning allows it to track automatically. Angular tracking rates up to 6° per second are possible.



Mating the first and second stages of a Discoverer satellite vehicle at Vandenberg A.F.B. Booster stage is a modified Thor IRBM and the second stage a Lockheed Agena powered by a Bell Hustler engine of 15,000-lb. s.t.

Conclusion

In the space of two short articles, it is obviously impossible to give more than a brief summary of the extensive facilities for missile and satellite operation that have been established in the Pacific area. Development of the Range was first authorized on Dec. 7, 1957. That it will expand still further in the years to come there can be little doubt for, as we showed last week, not only does the Range provide for the testing of missiles of all kinds but its Californian launching sites are also the ideal "springboards" for putting satellites into polar orbits.

Moreover, there are obvious possibilities for the operation and control of satellites girdling the Equator. There can be little doubt, too, that the pioneer work the U.S. Navy is doing with multi-stage solid-rockets for launching from ships and aircraft (p. 110) will enhance still further the flexibility of satellite operations.

PRINCIPAL EVENTS WITHIN PMR

1958	
Feb. 14	19,861 acres of Army's Camp Cooke transferred to Navy and designated Naval Missile Facility, Point Arguello.
Apr. 1	Work on radar installation begun on Tranquillion Peak, Point Arguello.
May 10	Point Arguello, commissioned by Rear Admiral J. P. Monroe. First missile, a Terrier SAM, fired.
Jne. 6	Navy's Regulus II SSM fired from Naval Missile Center, Point Mugu.
Jne.	"Operation Burn" started at Point Arguello to locate and remove unexploded artillery shells in preparation for construction; base declared a maximum security area by Dept. of Defense.
Aug. 19	Work started on NMFPA Technical Administration Building.
Oct.	PMR established down-range representative at Kanehoe Bay, Hawaii.
Nov. 24–26	U.S.S. "Koka" conducted recovery test on six parachuted capsules; results—good.
Dec. 10	First Regulus II launch from surface vessel, U.S.S. "Kings County."
Dec. 16	First Thor IRBM fired into range from Vandenberg A.F.B. by SAC personnel.
1959	
Jan.	First contracts awarded for missile launch complex at Point Arguello.
Feb. 28	First Discoverer launched from Vandenberg.
Apr. 13	Discoverer II launched from Vandenberg.
Apr. 15	EPS–16 radar on Tranquillion Peak completed.
Apr. 16	Thor-shot by R.A.F.
Apr. 16	Terriers launched by 2nd Marine Anti-Aircraft Battalion.
Apr. 29	Satellite tracking facility at South Point, Hawaii transferred to PMR.
May	Range instrumentation contract awarded.
May 5	Mobile satellite tracking facility and Fleet Missile Training facility established at Barking Sands, Kauai.
May 11	RARE fired at Point Arguello; first high-altitude firing.
Jne. 2	Missile Impact Locator system completed at Wake and Midway Islands.
Aug. 13	Discoverer V launched from Vandenberg.
Aug. 19	Discoverer VI launched from Vandenberg.
Oct. 12	First scheduled meteorological rocket launch at Point Mugu.
Nov. 7	Discoverer VII launched from Vandenberg.
Nov. 20	Discoverer VIII launched from Vandenberg.
1960	
Feb. 4	H.A.S. I launched from Point Arguello.
Feb. 4	Discoverer IX launched from Vandenberg.
Feb. 19	Discoverer X destroyed in flight by range safety officer.
Mar. 15	Successful guided Corvus flight.
Apr. 15	Discoverer XI launched from Vandenberg.
Jne. 29	Discoverer XII launched from Vandenberg.

Astronautics in the U.S. Navy

THE lecture by Capt, R. F. Freitag, Astronautics Officer of the U.S. Bureau of Naval Weapons, briefly recorded in last week's issue, has introduced a number of interesting points which might well be pondered by those concerned with shaping Britain's future space-programme. Speaking before a meeting of the Astronautics and Guided Flight Section of the R.Ae.S., Capt. Freitag had much to say of the practical outcome of naval aero-space research and development, and particularly emphasized the importance of effecting economies. He also gave the first indication of commercial opportunities arising from progress with satellites originally designed for military purposes.

One of the Navy's best successes to date was the Transit navigational satellite. This system, which was not envisaged in 1957, was the first really practical space-vehicle to have been developed. It was expected that four operational Transit satellites would be in orbit by 1962 in conjunction with special equipment aboard key ships of the U.S. Fleet. Precision shipboard equipment, the speaker said, would cost about $50,000. More general usage would come in 1963 and equipment suitable for commercial use would probably become available at about the same time. It was possible that drawings would be released for the licensed production of this shipboard equipment.

Two experimental Transit satellites already launched had provided navigational fixes on land accurate to within ¼-mile using the Doppler shift of their transmitted signals. Efforts were being made to miniaturize the satellite, first to reduce its dimensions from a sphere of 36-in. dia. to one of 20-in. dia., and ultimately to reduce this to 12-in. This would permit launching by smaller and more economical boosters.

With the Transit satellites, it was also possible to carry out geodetic observations to establish precise distances on the Earth's surface using triangulation methods. The Army and Navy were co-operating in this. Future satellites would be equipped for between two and five different experiments; a Canadian experiment was included in the payload of Transit 2A.

In weather reconnaissance, such as NASA were investigating with Tiros, the Navy was attempting to reduce the time lag between data readout from the satellite and the useful application of this information aboard ship.

Satellites capable of detecting and locating submerged submarines in conjunction with sono-buoys were another possibility the Navy had under study. An iceberg spotting system was also considered feasible. There was also interest in the use of probe rockets to ascend 190 miles or so above a task force for surveillance purposes.

The lecturer showed a diagram of the satellite detection fence spanning the United States at approximately the 31st parallel. This comprises a chain of antennae 16,000 ft. long and 200 ft. wide which projected a beam 140° wide and ¼° thick. Using radio interferometer techniques, it was capable of detecting satellites crossing the United States in a north-south direction up to a height of about 500 miles. It was hoped to extend this to 2,000 miles and to provide a second "fence" crossing the first at 45° to increase the coverage.

The existing "fence" had detected an "unknown" satellite on Feb. 1 (this was later identified as the ejected capsule of a Discoverer satellite launched the previous August); separation of the Soviet satellite-spaceship had also been observed.

Capt. Freitag next showed a diagram of the whole range of existing and projected U.S. space-boosters—from Scout to Nova. The Navy, he said, were trying to bring into being smaller rocket launchers at the lower end of the scale. One was an air-launched booster and another was related to Polaris in the shape of a "super-Scout." Moreover, it was hoped to move to sea-launching of satellites to provide greater flexibility of operation (e.g., equatorial launching from the Pacific Missile Range).

Of the air-launched variety, Capt. Freitag said that a four-stage, solid-propellent rocket could orbit small payloads (10 lb. to 50 lb.) cheaper and faster than other methods. It was possible to launch a 10,000-lb. booster from an aircraft performing a vertical "throw-up" manœuvre. Two stages of the rocket would be fired initially, the rocket being spin-stabilized during a coasting period before firing of the remaining stages. An IR scanner would seek the horizon before ignition of the third stage and the final stage would be fired by a timer. It was hoped to have an air-launched satellite in orbit this year.

Dyna-Soar Test Models

AERODYNAMIC and structural test models of the U.S.A.F.'s Dyna-Soar orbital boost-glider are to be built for launching over the Atlantic Missile Range within the next 12 months. Provisional contracts have been placed with two companies to provide the models; they will be launched by a variant of the Chance Vought Scout.

Under present arrangements, three structural models will be developed by the McDonnell Aircraft Corporation and two aerodynamic models by the Flight Sciences Laboratory of Buffalo, N.Y. The models, having the form of a narrow delta with small wing-tip extensions, are expected to weigh about 500 lb. Each will be mounted in the nose of a four-stage, all-solid, Scout booster which the Air Force has termed Hyper-Environmental Test System 609A. Launching is expected to be made at an altitude of about 56 miles at a speed of some 13,600 m.p.h.

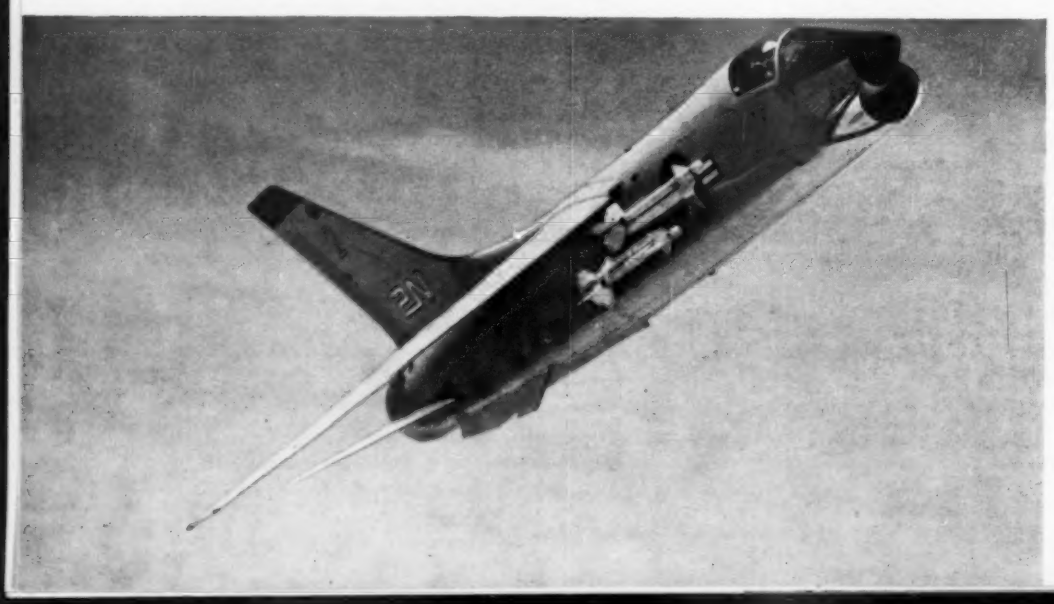
In the models to be provided by McDonnell, it is proposed to put full-scale structural specimens to test under the full range of conditions which will be experienced in the actual vehicle. The aerodynamic models should furnish data on air forces, frictional heating, moments, and pressure distribution, never before obtained in free-flight or in wind-tunnels.

It is not expected that the aerodynamic test models will be recovered. Each will be provided with a miniaturized recording and telemetering system for transmitting data to ground receiving stations.

Cities First?

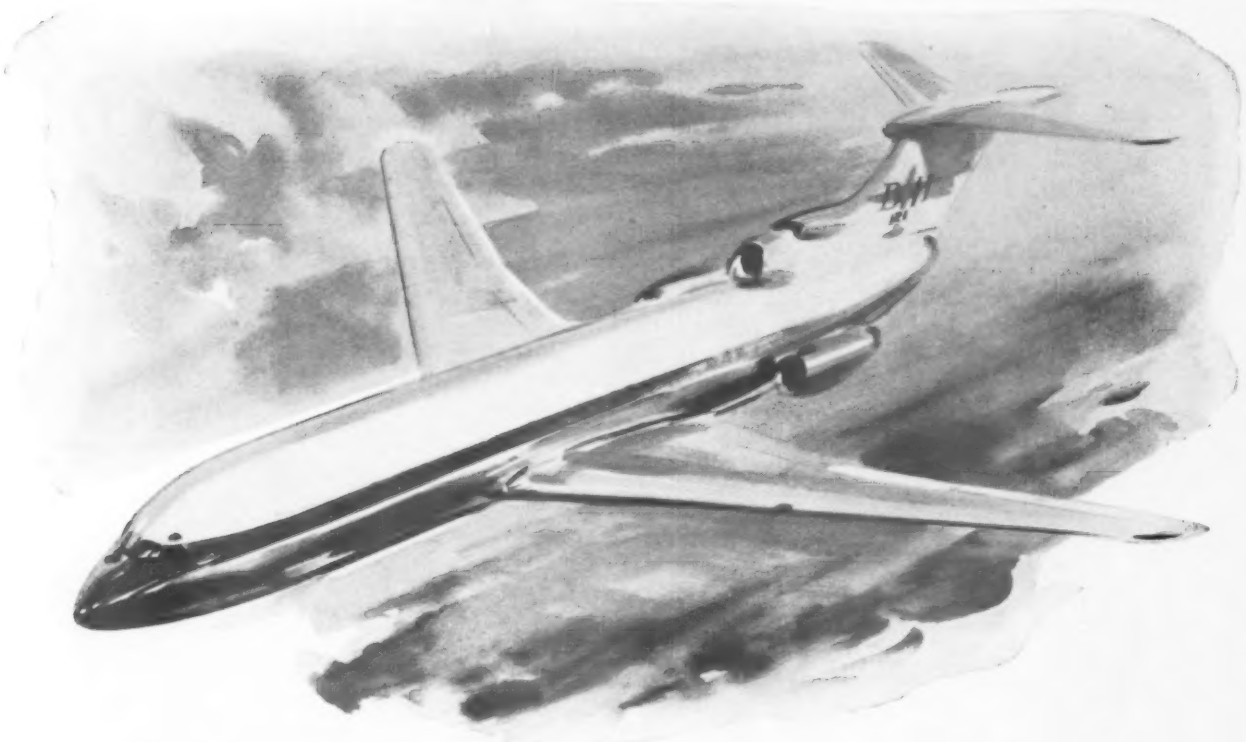
CHANGES in the distribution of Nike-Hercules surface-to-air missile sites have recently been announced by the U.S. Defense Department. The missiles had previously been assigned to protect seven Strategic Air Command bases and the city of Hanford, Washington, where an atomic explosives factory is situated.

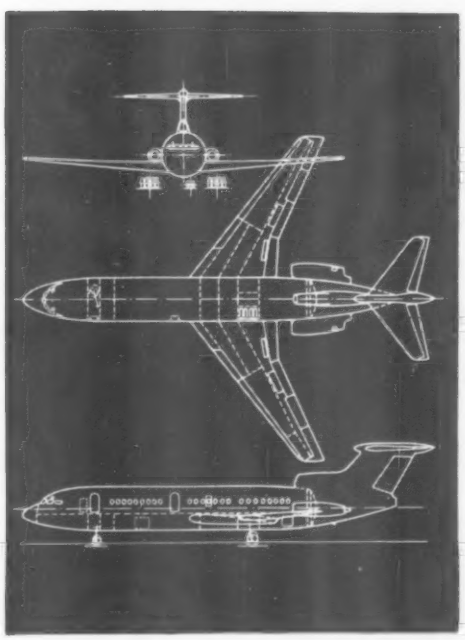
Under the new arrangements, Nike-Hercules will help defend Washington, Baltimore, New York, Detroit, Chicago, San Francisco and Los Angeles.



MISSILE CARRIER.—Four Sidewinder AAMs are carried by the latest version of the Chance-Vought Crusader; earlier versions carried only two. The all-weather F8U-2N first flew on February 16; deliveries to the U.S. Navy will begin later this year.

EXPERIENCE





DH 121

(Three Rolls-Royce R.B.163 by-pass jet engines)

The ultimate 600 m.p.h. airliner
for economical operations
throughout the world

Designed by
the most experienced team

Powered by the best engines

DE HAVILLAND

Freeze up

Low temperature lowers activity in all sorts of things; the flow of bees from the hive slows down, the oil in the engine flows more slowly. It's just as true in aviation. For this reason much AIR BP research activity has been devoted to low temperature performance of aviation fuel—towards the prevention of icing troubles and the preservation of perfect pumpability at the deep-freeze levels around 50,000 feet altitude.

Water separation equipment has achieved the first end, and the free water content of BP fuels as delivered is no higher than 30 parts per million.

Precisely judged refining has likewise established that BP aviation fuels remain fluid at temperatures far below those encountered in service.

AIR BP

THE AVIATION SERVICE OF BRITISH PETROLEUM

New Sailplanes at Butzweiler, 1960

by Peter W. Brooks

The German Phönix T needs further refinement.

THE International Gliding Championships, held at Butzweiler near Cologne, in Western Germany in June, provided the usual opportunity, which has occurred every two years since the War, to assess the present state of sailplane design and to review recent trends in this fascinating field. Following the pattern first adopted two years ago at Leszno, in Poland, the Championships this year were again divided in two—one competition being for unrestricted Open Class sailplanes and the other for the smaller, simpler, Standard Class machines.

There was, however, an important difference this year in that the two Classes, although marked separately, actually flew in identical contests and were launched in accordance with a single combined starting list. This meant that—unlike the competitions in Poland two years ago when the Standard Class was always launched separately, after the Open Class had got away, and were therefore somewhat at a disadvantage because the Standard entries often missed the best launching times on each day—this time every entry had an equal chance at the same task and it was therefore possible to compare directly the performances of the aircraft in the two Classes.

The entries from Russia, Czechoslovakia, Hungary and Canada were cancelled.

In the event, there were 20 entries in the Open and 35 in the Standard Class, making a total of 55, instead of the 67 which had been expected. The 55 competitors at Butzweiler compared with the 80 at the British National Championships at Lasham last year (the largest entry so far anywhere in the World in a first-class gliding contest).

The Open Class

Among the 20 entries in this Class, there were six British Slingsby Skylark IIIs, flown by British, Australian, Dutch, Italian and Argentinian pilots; two German Scheibe Zugvogels, flown by Israel and Sweden; two German Schleicher Ka 6s, flown by Denmark and Finland; two of the brand-new SZD Zefirs, flown as the Polish entry, and one each of eight other types, some old and some new.

The most interesting of the newcomers were the stimulating SZD Zefir 2s from Poland, which did exceptionally well and won second and third places in the Championship, and the German Bölkow Phönix T, which was flown by the previous World Champion Haase and also distinguished itself, although to a lesser extent, finally finishing ninth.

In addition, there were two American "one-off jobs," the Johnson RHJ-6 and the Schreder HP-8.

All the other entries in the Open Class were familiar designs which had been seen at previous championships. However, at least two of the older types, the Skylark IIIF flown by Tony Deane-Drummond and the single Yugoslav Meteor 60, incorporated new modifications.

The **SZD-19-2 Zefir 2** is the developed version of the SZD-19X Zefir 1 prototype which first flew in Poland on Jan. 4, 1959, and of which rumours and preliminary details were heard two years ago at Leszno (see "Polish Sailplanes" in THE AEROPLANE, Dec. 26, 1958). There is no doubt that the Zefir draws inspiration in a number of its features from the outstanding Czech Spartak (designed by Karel Dlouhy), which took part in the 1958 Championships and more recently established a World's distance record of 560 miles. Had the Spartak turned up it would have made a most interesting comparison with the Polish design, which is by B. Szuba.

The Zefir is a 17-metre sailplane of composite construction. The wing loading is 27.5 kg/m² and the claimed max. L/D 37 at 95 km./hr. The 20.5 aspect ratio two-piece wing offers up to a centre section which is integral with the fuselage. Access to the wing fix is through a narrow panel on top of the centre section.

The wing consists of a central plywood torsion-box to which a light-alloy D leading-edge and a plywood-covered metal trailing edge are attached. The surface finish is extremely good and the standard of waviness reasonable. The wing section has not been identified but is certainly laminar.

There are large Fowler flaps in six sections of approximately 30% chord, very similar to those on the Spartak and of comparable accuracy of fit. The flaps were reported to be hydraulically operated in the prototype, but they appear to be mechanical in the Zefir 2. They have a maximum angle of deflection of 20 degrees.

There are no dive brakes in the wings, which are of compound taper with a wide-span parallel section inboard. The only air brake is a drag parachute, which is stowed in the extremity of the tail cone.

The outstanding feature of the Zefir is its fuselage. This carries the almost fully reclining pilot philosophy, so effectively demonstrated in the Spartak, to its logical ultimate. Clearly a great deal of study has gone into this cockpit which has made possible a striking reduction in the depth of the fuselage and an associated reduction in cross-section of, perhaps, one-third on conventional practice. The savings in drag and weight are obvious.

At first sight, the pilot's posture looks as if it might be uncomfortable, but all who "sat" in the Zefirs at Butzweiler denied this. The Poles themselves said that, after about 10 hours' flying, they actually prefer the reclining position to the conventional upright seat. The pilot is, in effect, lying on his back on a slightly inclined couch with his head bent forward at about the angle it naturally assumes when one is standing at ease looking down at the ground close in front of one's feet.

The stick comes about halfway down the pilot's thighs and the instruments are on a T-shaped pedestal about halfway down his shins. The only serious criticism is that the instruments are too far from the eyes. They cannot be brought any nearer because they would then start to obstruct the knees, particularly of taller pilots.

The Zefir's cockpit is enclosed by a lengthy, beautifully shaped, forward-lifting clamshell canopy which blends perfectly with the rest of the long, shallow fuselage. The nose is of mixed metal and wood construction with plywood covering. The centre section of the fuselage is a built-up framework of welded-steel tubes, while the tail cone is an all-wood semi-monocoque with plywood covering.

The tail unit is, perhaps, the most remarkable of many unusual features. The prototype Zefir 1 had a conventional tail, but on the Zefir 2 the vertical surface is sharply swept back and the tailplane, with its single-piece elevator, is slotted partly into the rear of the fin somewhat higher than the top line of the fuselage. By this means the tail arm has been significantly increased for a given length of fuselage while, at the same time, the machine has been given that fashionable "swept look" which has now become almost as essential to "good sales appeal" in American light aeroplanes as tailfins are on motorcars!

The result of the various original design solutions combined in the Zefir's fuselage is a very obvious scaling-down and cleaning-up of this main source of parasitic drag. As a result, the whole machine looks smaller and less "draggy" than any previous 17-metre sailplane. Indeed, the designer has probably achieved the performance of an 18-metre wing with 17 metres.

Surprisingly, in view of recent trends, the rearward-retracting wheel on the Zefir is placed in the forward position, that is to say immediately under the leading edge of the wing. This arrangement has enabled the designer to dispense with a skid.

Another significant thing about the Zefir—and, for that matter, the Foka—is that it shows that the Poles have not been persuaded of the value of wing-tip shapes which, at the 1956 and 1958 Internationals, looked as if they might be winning general acceptance. The Zefir and Foka have very small endplates at the wing tips, but these seem primarily intended to provide mountings for the static discharge wicks and for the ground rubbing strips.

The second new European design in the Open Class was the German **Bölkow**

Poland's Zefir 2, outstanding in the open class.

NOSES.—L. to R., top and bottom—the Polish Zefir 2, the Polish Foka, the German Phönix T and the Austrian Standard Austria.

Phönix T, which is a development of the original Phönix of 1957, from which it differs most conspicuously in having a rather incongruous T-tail, obviously modified as an after-thought out of the original conventional unit.

The first Phönix was sent to America last year after gaining fifth place in the German National Championships. Like its predecessor, the new Phönix T is a 16-metre sailplane remarkable for its strikingly clean lines and for its novel sandwich structure, which makes use of a combination of glass-cloth, polyester resin and balsa wood. The wing loading is low—although somewhat higher in the new model than the 18.5 kg/m² of the prototype—and use is made of a new thin laminar section (EC 86(—3)—914) developed by Dr. R. Eppler.

Although the performance of the Phönix is probably as high as any yet achieved—the magic 40 for maximum lift/drag ratio is said to have been attained as a measured figure—it would appear that its handling characteristics leave something to be desired.

In particular, the ailerons are rumoured to be unsatisfactory. From their appearance, it would not be surprising if this were so. They have a total area of less than 5% of the wing and their shape is unusual because the hinge-line is set diagonally across the wing tip. Certainly, 1958 World Champion Haase, who was flying the Phönix, seemed to handle it gingerly early in the contest and, perhaps, never really got into his stride.

The Phönix's fuselage is a pure monocoque of exceptionally pleasing lines, although the forebody has to be of considerably deeper section than that of the Zefir because of the upright pilot's seat. It has a retractable wheel undercarriage instead of the simple faired skid of the original version and there is a rather noticeable re-entry in the under-surface line of the fuselage immediately aft of the wheel stowage which, by eye, looks too marked to be aerodynamically ideal. However, this may not be a valid criticism and is, in any case, the only one possible of an otherwise flawless shape.

In contrast to the high-aspect ratio ailerons and elevators, the rudder of the Phönix is of exceptionally wide chord. Surprisingly, it is fitted with a large anti-balance tab.

The wing is of similar construction to the fuselage, except that it has a box spar. Rigging is by the plug method. That is to say, the roots of the spars socket into the fuselage in the manner first seen to be increasing in popularity at Leszno two years ago. The dive brakes are plain flaps on the under surface of the wing only at 70% chord.

When Dr. Eppler went to the United States with the Phönix in 1959, Dick Johnson became interested in his ideas on laminar wing sections. As a result, a similar section to that of Phönix is used in the **RHJ-6,** which was one of the two new American Open Class sailplanes at Butzweiler. The "Brown Bomber," as the RHJ-6 was irreverently nicknamed by the British team because of its unpainted woodwork and massive appearance, looks most unusual with its T-tail startlingly like that of a Martin Marlin flying-boat and a cockpit completely enclosed within the large-section fuselage except for the pilot's head, which protrudes into a small, sideways-hinging, blister canopy.

The structure is primarily of wood with plywood skin, except that the rear part of the fin and the rudder and elevators are covered with fabric. The ailerons, on the other hand, are entirely ply-covered.

The dive brakes are of conventional top and bottom surface D.F.S. type and are positioned at 60% chord. They are of generous area, but are unusual in being in two independent sections in each wing—for no very obvious reason.

The second American design in the Open Class was Schreder's **Airmate HP-8,** an all-metal, vee-tail, 15.75-metre design with a shapely, if rather heavy-looking, fuselage. This entry was a last-minute substitute for the same designer's latest creation, the HP-9, which had to be scratched because it was not completed in time.

The vee-tail of the HP-8 does not de-rig, but the wing does so in three pieces. The centre section rests on top of the fuselage, where it is covered by a fairing, located by four pins, and secured by two tongues which slot into the fuselage.

Structurally, the design is quite conventional in light alloy, the fuselage being a straightforward monocoque and the wing with two spars and a fully stressed skin. The spars have built-up booms, perhaps 1½ × 1½ in. in section at the roots. The control surfaces are also metal-covered. There are D.F.S. dive brakes at about 40% chord.

The HP-8 is notable on two counts: first, it has an extremely good finish which owes much to the filling material used—a polyester resin—and, secondly, it has well-fitted, rather narrow-chord, plain flaps which are claimed to benefit the soaring performance and to be used regularly, when circling in thermals, deflected to angles of between 10 and 30 degrees. In "cruising" flight, the flaps are normally pulled up 5 degrees *above* the neutral position. Incidentally, the untidiness of these flaps at the wing roots is not up to the standard of the rest.

In spite of the claim of the effectiveness of these flaps, it is, perhaps, significant that, in the new HP-9, the designer is apparently going to something more complicated.

To sum up on the Open Class machines, the most important impression is of the advance in design represented by the Polish Zefir, particularly in the evidence it provides of a rethinking about fuselage layout, sparked off by the Czech Spartak's visit to Poland in 1958. The German Phönix T is a really clean design in the best traditions of the famous HKS prototypes which did so well in previous years. However, it needs further development to achieve its full potential.

The two American entries have some ingenious features, while the straightforward metal construction of the HP-8 sets an example to Europe which one would like to see followed. On the whole, however, and even allowing for the fact that they are designed for strong thermal conditions, the Americans did not show up well against the Europeans, and particularly against Poland and Germany.

The British Skylark III's achievement in winning the Championship, in the hands of the Argentinian Hossinger, convincingly caps the previous evidence on the qualities of this down-to-earth 1955 production design which came second in 1958 and sixth in 1956. Further sales should benefit as a result—and deservedly so.

Nick Goodhart's remarkable performance in the Elliotts Olympia 419, which might so easily have given him the Championship if chance had been a little kinder, brought this aircraft up to fourth place, compared with seventh in 1958. On this showing, the British designers have done well and are keeping this country to the fore in practical, production, high-performance machines.

Nevertheless, the warnings which were to be read at the 1956 and 1958 Championships are still clear: British sailplane design is lagging badly behind progress on the Continent. Although our excellent production types are today still effectively holding their own against allcomers, they cannot hope to do so indefinitely.

The Standard Class

The 1960 Championships completely vindicated the decision of four years ago to introduce a Standard Class into international competition gliding, which would be reserved to practical, easy-to-fly, 15-metre machines suitable for general club use. The remarkable fact at Butzweiler was that the Standard Class types actually did better than their bigger and more expensive brethren. This was no doubt due, at least in part, to the far-from-easy weather conditions and the bad task-setting on many days which unintentionally made the flying even more difficult than it might otherwise have been. There seems to be little doubt that in races round closed circuits and in hard-to-work lift, particularly in bad visibility over inhospitable country, the handier, more manœuvrable, 15-metre design is better placed against larger machines than it is under easier conditions.

Whatever the reasons, there was a generally accepted impression that many of the Standard Class machines, while flying the same tasks in a common starting list with the Open Class, did significantly better than the "big boys." Three of the Standard Class entries did, in fact, score more marks than the winner of the Open Class and, on points, six Standard Class entries were well up amongst the leading five Open Class placings—this in spite of the fact that the much larger entry in the Standard Class made the competition keener.

Among the Standard Class entries there were four entirely new designs and one partly new. These will all be considered here. In addition, at least two slight modifications of previously familiar aircraft were noticed during a rather superficial look over the rest of the field. By far the most numerous entry was of the German Schleicher Ka 6 (two of which, as already noted, also took part in the Open Class). This is the design which won the OSTIV Standard Class Design Competition at Leszno two years ago.

The Ka 6's popularity was reflected at Butzweiler in the fact that no fewer than 16 of the 35 entries in the Standard Class were Ka 6s of one sub-type or another. Even more significant, in the results, five of the first six places—including first and second place—went to pilots flying this type. While on the subject of the Ka 6, it should be

noted that the winner, Heinz Huth of Germany, flew what appeared to be the latest model, which differs from its predecessors in having an all-flying tail—although, apparently, without geared tabs—no skid and a rudder which has finally dispensed with its horn balance. (Previous versions have horn-balanced rudders, although the horn has been progressively reduced in area in succeeding models.)

The most numerous type in the Standard Class after the Ka 6 was the French Breguet 905, of which there were four. There were two each of the following types: German Zugvogel IV, Polish SZD Mucha-Standart, Finnish PIK-3C and British Slingsby Skylark II, and single examples of five other designs.

Winner of the OSTIV Standard Class Design Prize this year, and certainly the most notable of the new 15-metre designs, was the Austrian **Standard Austria,** of which two examples were entered as that country's team. Designed by Rüdiger Kunz, the Austrias were placed seventh and ninth in the final results, but these positions do not give a true measure of the impression they made at Butzweiler.

They were somewhat less dashing in appearance than the Polish Foka—which is discussed below and which appeared superficially to be a slightly scaled-down and rather more swept Zefir—but for what the Austrias lacked in dash they made up in simplicity, balance and purity of line. Indeed, few flying machines since 1903 can have been æsthetically more pleasing in appearance.

The Standard Austria has a 15-metre two-piece wing of medium aspect ratio (16.7) and moderately thin NACA 65, 415 laminar section. The wing loading is also moderate at 22.0 kg/m². The surface finish and freedom from waviness of the wing is outstanding—as, indeed, it is over the whole machine—and this is achieved with a simple wooden structure with a ply covering over all but a small part of the rear undersurface. The good contour is maintained by nothing more complicated than closely spaced spanwise stringers. Normal D.F.S. dive brakes are mounted in the wings at 70% chord.

The fuselage shape and accuracy of contour are well up to the high standard of the wing, while the canopy blends in well. The pilot is seated in a reclining position, which helps to reduce the fuselage cross-section somewhat, although this device is not taken to the extremes that it is in the Zefir and Foka. By adopting a flat bottom line to the fuselage, the designer has been able to use a 38-cm. wheel which looks, nevertheless, as if it is adequate for its job.

The tail of the Austria is the most unusual feature of a design whose merit lies primarily in sensible compromises between the too conventional and the too radical. It is an all-flying vee-tail with anti-balance tabs, reminiscent of that tried in this country on the Kendall K-1 Crabpot two-seater prototype of 1953, and it seems to work most satisfactorily.

The real proof of the success of the Standard Austria in meeting its design objective will be its selling price. The manufacturers estimate that it will cost £1,100.

Where the Standard Austria is restrained, the Polish **SZD-24 Foka** is dramatic, and certainly the average reaction to a first sight of this remarkable design was one of incredulity that it could be in the Standard Class. The Poles brought two Fokas to Cologne, but only one was entered in the competition because of the restriction to a maximum of three entries from each country. This machine, in the capable hands of Adam Witek, flew much of the time in company with its Open Class compatriots, the two Zefirs.

The three made a formidable team and, except on the rare occasions when they "came unstuck" together, they were usually also together amongst the leaders. In the event, the Foka gained third place in the Standard Class but, as with the Zefirs amongst the big machines, it spent its time breathing down the necks of the leaders—when it was not itself actually leading.

While the configuration of the Foka is closely similar to that of the Zefir, with almost fully reclining pilot, shallow fuselage, swept—in fact, still more sharply swept—tail and a tailplane which slots in from the back, structurally it is entirely different. (The difference in undercarriage has already been noted.)

Where the Zefir is of wood and metal construction, the Foka is wood and plastic with a ply-and-foam sandwich skin to both fuselage and wings, except for part of the latter's rear undersurface, which has fabric covering. The wing looks thicker than that of the Zefir but, even so, is reported to be of NACA 63 series section only 12% thick at the root and 9% at the tip. The surface finish is excellent, but the standard of waviness is not outstanding.

The wing loading, at 24.7 kg/m², is somewhat less than that of the Zefir, while the claimed max. glide ratio is 34 at 86 km/hr. Indeed, it appears that the performance is only slightly inferior to that of the Zefir. D.F.S. dive brakes, located in the wings at 60% chord, are of mixed wood and metal construction incorporating overlapping plates on a common linkage. They stow away neatly. There are not, of course, any flaps on this Standard Class machine, but the ailerons, and the elevators, are of high aspect ratio like those of the Zefir.

The cockpit of the Foka is similar to that of the Zefir with the pilot also in an almost fully reclining position, but the canopy slides forward to open, in similar fashion to the Spartak and Demant, instead of being of the clamshell type. The price of the Foka, is expected to be between £800 and £900.

The other two new Standard Class designs at Butzweiler were both Italian prototypes. They were the **SSVV E/C 39-59 Uribel** and the **Aéromere Trento M100S.** The E/C 39 is a single-seat development of the two-seat E/C 38-56 Urendo designed by Edgardo Ciani. It is a creditably clean shoulder-wing design with a vee-tail. There is compound taper on both the leading and trailing edges of the wing which looks as if it might be the same as that used on the E/C 38 two-seater. The leading edge of the inboard section is swept forward, giving the E/C 39 also, with its large cockpit canopy, the appearance of being a two-seater. There are conventional D.F.S. dive brakes at about 60% chord and small shapes at the tips.

The undercarriage consists of a main skid forward and a rather small, well-faired, fixed wheel. Altogether there is little notable about this design, except for the glass-fibre fuselage of excellent shape, which is, however, rather spoilt by the unnecessarily complicated geometry of the wing.

The M100S is as different in appearance to the E/C 39 as it could possibly be. The front fuselage is of comparatively large section which blends, not very neatly, into what almost becomes a rear fuselage boom. The conventional tail is a rather untidy-looking unit with a long dorsal fin, not improved by a prominent "suitcase handle" handhold for lifting the tail. There is a small main skid with a rather inadequate-looking wheel.

The wing is structurally simpler than that of the E/C 39 and is notable chiefly for the unconventional inter-rib dive brakes. Neither of the Italian designs makes any great claim to constructive originality, either structurally or aerodynamically. However, the M100S did well to achieve eighth place in a field of 35.

An interesting entrant in the Standard Class flying contest, although it was not entered in the design competition, was the all-metal American **Schweizer SGS-1-23H,** a modification of the familiar standard 1-23 which originally appeared in 1948 and is, perhaps, best known in its later (1952) 1-23D form, which took part in the 1954 Championships at Camphill. This is a 15.3-metre design. The 1-23H is a special development to meet the Standard Class requirements and is essentially the same fuselage and tail unit to which a new compound-tapered 15-metre wing has been added.

The wing is still of the thin non-laminar NACA 43 series section 12% thick at the root, tapering to 9% at the tip. There are two-piece all-metal ailerons inset from the tips. The air brakes are of the double-spoiler type set at 50% chord. The most notable feature of the 1-23H is the excellent finish of the wing, which represents an important advance on anything seen before from Schweizer's.

New modifications on previously seen designs which appeared in the Standard Class at Butzweiler included the altered tail on some of the Ka 6s, already mentioned, the Skylark IIB with its improved cockpit canopy, the Breguet 905S Fauvette production aircraft, which has some small changes as compared with the protoype which appeared at Leszno, and the Scheibe Zugvogel IVA, which is the Mark IV fitted with a fixed wheel at 30% of the wing chord enabling it, for the first time, to comply fully with the requirements of the Standard Class regulations. The Breguet 905s were a disappointment this year. All four entered were in the lower half of the field.

Summing up on the Standard Class entries, one can reiterate only praise for the Standard Austria as a new design of the greatest promise. As long as the Standard Class stimulates such developments it will continue to benefit greatly the gliding movement as a whole. The Polish Foka is also a notable development which showed, better than any other machine this year, that advanced thinking applied within the limitations of the Standard Class can produce performances as outstanding as anything possible outside these limitations.

Apart from the Standard Austria and Foka, the main thing which came out of the 1960 Standard Class Championships was further evidence that the German revival in gliding is producing some notable machines—of which the Ka 6 is the oustanding example. These are fast restoring to Germany her pre-War pre-eminent position in this dynamic sport, with its unique scope for progress in both technical development and flying technique.

TAILS.—The German Phönix T, the Polish Foka, the Polish Zefir 2 and the U.S. Johnson RHJ 6.

Personal Flying

Flying the Piper Caribbean

by John Fricker

SINCE the relaxation of restrictions on the import of American aircraft into this country a year or so ago, the best-selling individual design has undoubtedly proved to be the Piper Tri-Pacer series. Its variants outnumber all other American light aeroplanes on the current British register, which lists some 27 PA-22s. These comprise 18 Tri-Pacers, all but three being the latest 160 b.h.p. version, and nine Caribbeans.

The Tri-Pacer and Caribbean have identical airframes and similar powerplants, but the latter type is more simply equipped, and its Lycoming O-320 flat-four engine has a lower compression ratio. Using 80 octane fuel, it develops 150 b.h.p. at 2,700 r.p.m. for take-off, compared with the 160 b.h.p. of the Tri-Pacer's O-320-B on a minimum of 91 octane fuel.

Despite this slight decrease in power, the Caribbean is no slouch, since the original Tri-Pacer started life in 1951 with only 125 b.h.p. under its cowling. Its performance is quite remarkable for a strut-braced, steel-tube and metal-framed, fabric-covered design with a fixed nosewheel undercarriage, and having flown all the Tri-Pacer variants (my original flight assessment was on Mar. 13, 1953), there seemed to me surprisingly little between them in take-off, climb and cruise.

As a utility version of the Tri-Pacer, the Caribbean is aimed more at flying schools and clubs than the executive market, and at £4,320, delivered and duty paid in standard form in the U.K., it is the cheapest four-seater available for import. The Tri-Pacer is only about £200 more, and the very low cost of these designs accounts in part for the sale of some 8,000 to date.

Equally attractive, however, is their very high standard of finish, both external, where the Butyrate-doped fabric and excellent metal panelling are concerned, and in the colourful car-type interior. This invites relaxation and has a pleasantly non-technical atmosphere for the businessman pilot. It is becoming almost trite to stress the American automotive approach to personal flying, but it is undeniably the single key to its sweeping success.

I had an unusually good opportunity to assess the qualities of this approach by being able to live with a Caribbean for a week, and to become thoroughly familiar with its handling. The original purpose of the loan of G-APXO from Vigors Aviation at Kidlington was to fly the Caribbean in the Air Touring Competition, and although this was regrettably defeated by weather, I was able to undertake extensive cruising consumption tests and to practise optimum take-off and landing techniques.

Resplendent in glossy red and white finish, but without the optional fibreglass spats on its tricycle gear, G-APXO awaited me at Air Couriers, Biggin Hill, after installation of the little Narco Superhomer VHF. Noteworthy points during a quick walk-round were the fixed-pitch Sensenich metal airscrew, the finger-operated fasteners for the engine cowling, the equal-sized wheels on all three undercarriage legs, the external access door on the starboard side to the rear baggage compartment, and the variable-incidence tailplane for longitudinal trim.

Cabin access is via a well-placed step on the undercarriage leg fairing, and two entrance doors. For some reason, the door for the front pair of seats is on the starboard side, so that the pilot always has to slide across the cabin, while the rear door is on the port. The rear seats are removable in 15 seconds, leaving up to 42 cu. ft. of cargo space. Cabin room is adequate, but the view is not good, except sideways and to the rear. With no roof transparencies, the usual high-wing view penalty is particularly marked in anything but the most gentle of turns, and forward visibility is restricted by the deep instrument panel.

In the Caribbean, this has very little on it, except for basic flight and engine instruments, but space, as well as mounting holes, is ample for a full IMC installation. The few instruments are on the left of the panel, only the fuel gauges for the two 15-Imp.-gal. wing tanks, and the ammeter, remaining to starboard.

At the bottom of the panel are minor controls for lighting, front and rear cabin heating, parking brake, cigar lighter, etc. In the centre is the throttle plunger flanked by ignition and mixture controls. Apart from the separate controls for supplying warm air to the front and rear seats, Caribbean comfort is aided by an opening quarter-light on the pilot's side and individual ventilators for each occupant.

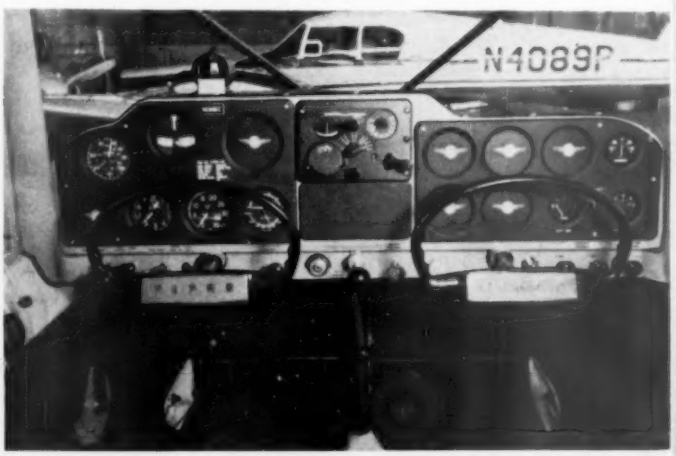
Dual handwheels and rudder pedals are fitted as standard, but braking is done non-differentially by a hand lever below the central panel. This is a standard Piper system, being found also in the Comanche, and with the nosewheel steering through 40 degrees from the rudder pedals, gives good ground manœuvrability for all except the tightest turns.

The remaining controls comprise a three-position manual flap lever between the front seats, the usual Piper crank for longitudinal trim in the roof, and the fuel selector on the port cockpit wall. A priming plunger is provided on the front panel, but except possibly in very cold weather, an adequate prime for starting can be achieved by a few pumps with the throttle.

A 6.6-Imp.-gal. auxiliary fuel tank can be installed in the baggage compartment if required and, as usual in most light aircraft, when added to the full fuel load, makes the Caribbean a three-seater within the normal gross weight. With a 900-lb. payload the aircraft has to be loaded with some care if four men, for example, are on board, since with the normal maximum fuel tankage, no baggage could then officially be carried. The baggage compartment has a maximum capacity of 100 lb. On the other hand, I recently flew a 135 b.h.p. Tri-Pacer carrying three passengers and full tanks without realizing that we were thus exceeding the maximum gross weight. I must say that it seemed to have very little effect on the take-off, climb and general handling.

When I came to fly the Caribbean away from Biggin, it was fortunate that I had spent several hours in Tri-Pacers at Kidlington, since I might have spent a similar amount of time in locating the starter button. This is under a small box, which also houses the master switch, and is positioned below the first pilot's seat. The Lycoming starts easily and idles quietly with its characteristic rattling rumble subdued by extensive soundproofing.

Taxi-ing is effortless, and pressure with either foot results in a rapid turn. At this point, you may notice that the



CARIBBEAN COCKPIT.—As a utility version of the Tri-Pacer, the Piper Caribbean has only basic instruments, although the cockpit furnishings are to the same high standard.

control wheels turn slightly in the appropriate direction at the same time and you then recall that the Tri-Pacer series has interconnected rudder and ailerons. These provide co-ordinated turns in the air so that the aircraft may be "driven," feet-off, rather than flown, but the interconnection is by springs, so that the controls may be crossed if required.

With its big wheels, and combined bungee and "Hydrasorb" shock absorbers, the Caribbean irons out bumpy turf in a remarkable manner, and the nosewheel leg seems sturdy enough to cope with the roughest of surfaces. Warm-up of the closely cowled Lycoming takes no longer than the time to taxi out, and take-off is possible as soon as the throttle can be opened without the engine faltering.

The excellent leverage provided by the hand control for the hydraulic brakes makes them very powerful and effective, and the parking catch is equally positive. This makes possible a technique for very short take-offs, which was practised for the Air Touring Competition. The brakes will hold comfortably at full power, which is applied after the usual vital actions and selection of neutral trim with the low-geared handle.

The parking-brake handle is then pushed in, the aircraft kept straight with a little right rudder, and the control wheel held just aft of neutral. Soon after the A.S.I. begins to register at 40 m.p.h., the flap lever between the seats is raised smartly to dump full flap, and the Caribbean promptly leaps into the air at about 50 m.p.h. With this technique, and a very light wind, when flying solo, take-off runs of 110-120 yd. were paced out, and the experts can do it in less than 100 yd. A very steep initial climb is achieved at about 60 m.p.h., which will get the Caribbean out of a remarkably confined space.

Full flap is used because their area is relatively small, and their maximum extension is only about 40 degrees. After a conventional flapless take-off, which is still very short, with an unstick at about 60 m.p.h., climb-away at full load is brisk at more than 700 ft./min., compared with 800 ft./min for the Tri-Pacer. At the recommended climbing speed of 80 m.p.h., the angle of ascent is impressively steep, but the raised nose restricts the forward view still further.

With its interlinked control system, the Caribbean is a lazy man's aeroplane and, although right rudder must be held during the climb, the aircraft may be flown solely by the control-wheel in cruising flight. A wide range of power setting is available up to the maximum continuous figure of 2,650 r.p.m., which at the full throttle height of 7,000 ft. or so returns a T.A.S. of 132 m.p.h. for a consumption of 10 Imp. gal./hr.

At the other extreme, 2,000 r.p.m. will still give a comfortable 100 m.p.h. at low altitudes for training, and is claimed to burn little more than 4 gal./hr. This ties up quite well with the consumption tests which I performed on G-APXO, which at the selected 2,200 r.p.m. returned an indicated 115 m.p.h. for a consumption of only 5 Imp. gal./hr. This was at 2,000 ft., to meet the Touring Competition requirements, using the leanest practical mixture by means of the manual control.

The little Caribbean certainly clips along at these low power settings, and its cruising flexibility makes it an excellent choice for touring. It is very comfortable and completely undemanding of its pilot, with a moderately low noise level, and its ultimate normal endurance of more than six hours would not prove excessively fatiguing.

Some control feel precision is naturally lost to the springs in the circuit, but this does not prevent the Caribbean from being pleasant to fly. An effective demonstration can be made of tight turns performed feet-off with the ball of the turn-and-slip indicator firmly in the centre. Control forces are moderate, and the small longitudinal trim changes can be effectively cancelled by the low-geared tailplane handle, once you can remember which way to wind it.

Stability is good at all times although a slight tendency to wallow at times in rough air may be a by-product of the interlinked controls. Otherwise these seem to have no adverse effects, although the impression may be gained that they largely achieve mechanically what most well-designed aircraft demonstrate aerodynamically.

On closing the throttle in the Caribbean, several clockwise turns of the trim crank are needed to prevent the nose dropping too steeply in the glide, and with a further aft pull of the control wheel the clean stall comes—after a brief buffet—at about 50 m.p.h. As soon as the nose drops, however, the Caribbean is flying again, and continued aft pressure simply results in an oscillating descent, with full lateral control, at a low rate of sink.

Lowering flap below 95 m.p.h. gives a mild nose-up trim change, and with a trickle of power, an extraordinary angle is reached after some hard work before the stall follows at about 45 m.p.h. I.A.S. The breakaway is again not overpronounced, although a mild drop of the port wing may become apparent, and the total height loss is negligible. I tried *g*-stalling the Caribbean by a sudden aft pull at a very slow airspeed, but despite its clipped Cub wing of less than 30-ft. span, it refused to be provoked into any spectacular manœuvre.

Because of its small wing and relatively tiny flaps, the PA-22 has a fairly fast approach performance and does not feel comfortable below 70 m.p.h. in a power-assisted glide. Power-off, 75-80 m.p.h. gives a pleasantly steep approach path and plenty of elevator power for a fairly prolonged hold-off and a minimum speed touch-down. A tail-down arrival results at about 50 m.p.h., and the nosewheel makes contact almost immediately to give one full directional control. Mainwheel braking then feels both desirable and convenient, and with its assistance an experienced Caribbean pilot can stop within 100 yd. of touch-down.

In the course of demonstrating Tri-Pacers and the Caribbean to pilots of varying experiences, I have been treated to some fairly spine-shattering arrivals, but the aircraft seem tremendously robust, and take that sort of thing in their stride. Summing up the PA-22 series, I would say that its worst feature is undoubtedly the poor all-round view, but that in performance, robustness, handling and economy it is otherwise remarkable value for money.

LEADING PARTICULARS

DIMENSIONS.—Span, 29 ft. 3½ in.; length, 20 ft. 7¼ in.; height, 8 ft. 4 in.; wing area, 147.5 sq. ft.

WEIGHTS.—Empty, 1,100 lb.; loaded, 2,000 lb.

PERFORMANCE.—Max. speed, 139 m.p.h.; cruising speed, 75% power, at 7,000 ft., 132 m.p.h.; stalling speed, 49 m.p.h.; initial climb, 725 ft./min.; service ceiling, 15,000 ft.; normal range with 30 Imp. gal.-fuel, 528 miles; take-off distance to 50 ft., 1,800 ft.; landing distance from 50 ft., 1,280 ft.

BEECH Travel-Airs are in the news. Three of the 1960 version of this five-seat light-twin have been ordered by North American Aviation Inc. for the executive transport of some of its missiles and space travel staff. The North American pilots have been flying some 2,400 passengers per month between N.A.A. production and test facilities at Los Angeles International Airport, Edwards AFB, Downey and Palmdale.

One of the reasons for selection of the B95 Travel-Air, after evaluation of other American light twins, was the layout of its instrument panel, since about 68% of all N.A.A. executive flights involve some IMC operations. So much for sunny California.

On the other side of the Atlantic, a Travel-Air has been fitted, for test-bed purposes, with two Turbomeca Astazou turboprops and Ratier-Figeac airscrews by S.F.E.R.M.A. This is a further stage in the development of these 450 s.h.p. lightweight units, which have automatic power control systems. In the Travel-Air, they replace the 180 b.h.p. Lycoming piston-engines, and produce well over twice the horsepower for only 200 lb. or so increase in weight.

• • •

A new helicopter for the business aircraft market was recently unveiled by the Hiller Aircraft Corporation at a San Francisco ceremony, which saw the presentation of the four-seat Model 12E-4. This initial entry of Hiller into the rotorcraft executive field was accompanied by an acknowledgment from Stanley Hiller, Jr., president of the company, that the helicopter was a specialized tool of business, industry and the military, and was not, nor was likely to become, a mass consumer vehicle.

Mr. Hiller accepted partial responsibility for the unrealistic image of helicopters resulting from earlier predictions that "our products could some day be in commuter garages and hunting lodges." "No longer," he said, "do experienced helicopter manufacturers compromise utility and performance

TURBOMECA TRAVEL-AIR.—A drastic increase in power has accompanied the installation of two 450 s.h.p. Turbomeca Astazou turboprops in place of the normal 180 b.h.p. Lycomings, for development purposes.

Personal Flying . . . .

in favour of this false market." In the military, industrial, executive and interurban transport markets, however, he forecast a 10-fold increase of the country's helicopter sales within the next 10 years.

With a 305-b.h.p. Lycoming engine, the widened-fuselage UH-12E-4 was developed from the Hiller H-23D, via the three-seat 12E, and the last-mentioned helicopter may be modified if required by a kit into the executive variant. At $69,960, the four-seat Hiller is the lowest-priced helicopter of this capacity on the American market.

• • •

In South Africa, the General Aircraft Company is building the two-seat Piel Emeraude, modified by its chairman and managing director, as the Aeriel Mk. II. With a 95-b.h.p. Continental C-90 engine, the Aeriel Mk. II is being sold for a quoted price of £1,975, and several orders are reported to have been received in the Union.

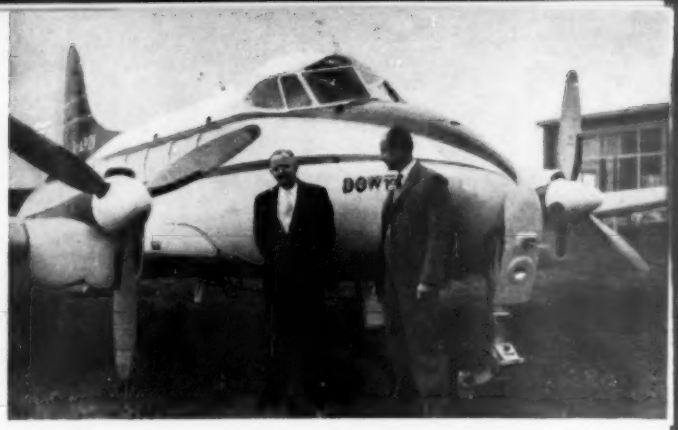
The all-wood Emeraude is being built in this country by Garland Aircraft as the Linnet, and many have been produced in France.

• • •

In its native country, the CP301 C.1 Emeraude recently obtained its public transport category C. of A. in the class corresponding to the American CAR3. A Danish C. of A. resulted in an order for three Emeraudes for that country, and Scintex-Aviation is laying down a further 25 of these aircraft.

French production of another light aeroplane, the Morane-Saulnier M.S.880 Rallye all-metal three-seater, is being established for an initial batch of 250 aircraft following firm domestic orders for 150, plus 35 for export. The first production Rallyes are due early in 1961, and the monthly rate will gradually reach 45 aircraft, or two produced each working day.

Two versions of the Rallye will be produced; the "Club" type, and the more advanced Super-Rallye. The latter will have a 20-channel VHF set and additional fuel, and will cruise at 113 knots over 683 miles. Price about £2,500.



EXECUTIVE USE.—The Dowty Group, of Cheltenham, recently entered executive operations with the purchase of a new D.H. Dove, G-APZU. Its pilot will be Sqn. Ldr. Neville Duke, who is seen here with Sir George Dowty.

● For the second year running, the **Armstrong Whitworth Aircraft Flying Group** at Coventry has been awarded the Masefield Trophy of the P.F.A. as its most efficient member organization. The A.W.A. Group was the first to win the Trophy for a second time, and achieved this with only one aeroplane—a Tiger Moth. It was competing against more than 90 groups, including several with half a dozen aircraft.

● R.Ae.C. approval has now been granted to Mr. Rich, C.F.I. of the **Norfolk and Norwich Aero Club** for observing the practical flying tests and examining applicants for P.P.L.s. Six members have recently qualified for their licences.

● The first course of the **Scottish Parachute Club**, from Jne. 4-11, at Perth, was marred by a fatality, when one member failed to open his parachute within the specified time. Despite this unfortunate accident, and the poor weather which allowed only nine jumping days, 115 descents were made under the supervision of instructors, Sgts. P. Denley and K. J. Teesdale. Jumps were made from a Rapide, and also an Auster, flown by Mr. T. Blyth, A. Anderson, and the airport manager, Wg. Cdr. F. D. Nugent. Five members qualified for the general permit and "B" licence, while Dr. C. A. Robertson also qualified for his "C."

Gliding Notes

by Dr. A. E. Slater

A COMPLIMENT to British gliding achievements is paid in the June issue of *Soaring* by Dr. Harner Selvidge, president of the Soaring Society of America. He particularly stresses what British pilots can do "under adverse circumstances" and quotes, among others, Gp. Capt. Kearon's flight during last year's Championships in which he flew 134 miles without ever getting above 1,000 ft. Dr. Selvidge also notes how British pilots, in using waves, "are consistently reaching altitudes of six to eight times the height of the ridge in what would seem moderate winds to us."

One is reminded of Betsy Woodward's remark soon after she began soaring in England. When she used to find herself at 3,000 ft. over American soil she would say to herself: "My, I am low"; but on finding herself the same height over British soil she would think herself high.

It may or may not be significant that during the World Championships, when Nicholas Goodhart far outflew the rest on a very difficult day and the International Jury voted on the interpretation of the rules, those countries in the Northern Hemisphere which favoured an interpretation allowing him to retain his 1,000 points were all located in the more northerly latitudes, where difficult soaring days are common; whereas those against came from better thermal regions nearer the equator.

However, when we compare our summer soaring conditions with those in Japan we ought to be thankful. The team manager from that country, when I met him at Butzweiler, gave some information about his native thermals though, having very little English and no German, he conveyed it mostly by drawing rings round the various months in a calendar.

It appears that thermals in Japan are no good at all in the second half of June, nor during the whole of July and August. They are at their best in May and October, but still fairly good in November and December.

Their pilot Isamu Oda, who has now flown in three World Championships, recently covered 400 km. in Japan from Osaka E.N.E. to Tokyo, flying in company with another pilot, each of them using a British Skylark 3b.

• • •

IN the first sentence of my last account of the World Championships, memories of 1958 crept into the first paragraph and caused an error. This time Nicholas Goodhart flew an Olympia 419 and Tony Deane-Drummond a Skylark 3. Last time it was the other way round.

• • •

IN contrast to Japan, Indian thermals are traditionally plentiful—or the vultures might starve. Mr. Mahendra Singh Pujji, the first and only Indian Gold "C" pilot, who turned up at Butzweiler with a party of his fellow-countrymen on the invitation of the German Government, said that the thermals there are at their best in April.

It was only in April this year that "away landings" in gliders were allowed in India at all, so we cannot yet guess the size and competence of the Indian team which, he hopes, will fly in the next Championships.

All Indian gliding is run by the Government, with the result that a launch only costs one rupee (1s. 6d.). Launches are by winch, except at Delhi where aerotowing is laid on.

The Indians might even take a tip from their vultures. The late J. W. Dunne, who pioneered tailless aeroplanes half a century ago, once saw a group of vultures in India flapping round and round in circles just above the ground. Then, suddenly, they all rose a short way and immediately caught a thermal, which they had evidently released by churning up the surface air.

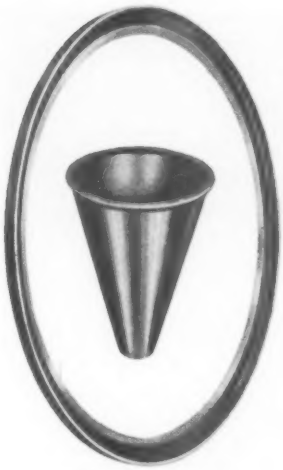
• • •

"SO that flying may continue through the day without interruption, thus increasing the number of launches and flying hours, the Committee has decided that for a trial period of one month as from Jne. 9 there will be only pack lunches available, and only to those members who have previously booked. The pack meals will be brought onto the airfield and paid for by tickets bought in the bar." This circular from the Derbyshire and Lancashire Gliding Club arrived at Butzweiler just as I was about to start on a packed lunch provided by the caterers at the World Gliding Championships.

For 30 years, ever since Wolf Hirth first demonstrated the art of thermal soaring in 1930, everybody has known that the best thermals of the day are to be caught at lunch-time. Yet this year, so far as I can remember, is the first in which, both nationally and internationally, packed lunches have been the inescapable routine, without alternative, at any gliding centre.

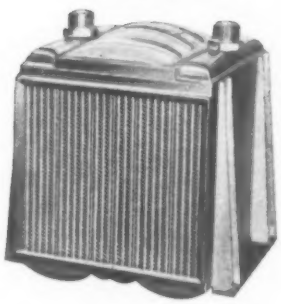
The trouble has always been a clash of interests between glider pilots, who like to be sure of assuaging their hunger no matter what time they land, and caterers, who prefer all flying to stop at conventional meal-times so that they can get everybody fed and then enjoy a nice long gap before the next meal.

At Delaney Gallay



We can Flow Turn Nimonic, Stainless Steel, Light Alloy—

Flow turning makes lengthy and expensive tooling-up processes unnecessary. It enables us to produce such things as flanged rings, nose cones and similar items quickly and cheaply. It enables you to have 'one-off' at very short notice before production begins. Saves time. Saves money. Care to discuss?



and Braze very thin gauge Stainless Steel & Light Alloys

Light alloys we braze in the flux bath, stainless steel, nimonic and the like in our vacuum furnace. In the flux bath we can produce units smaller and lighter than can be produced by any other method. In the vacuum furnace we can often produce in stainless steel units of no greater weight than their equivalents in light alloy. For you?

We also produce the finest aircraft toilet available

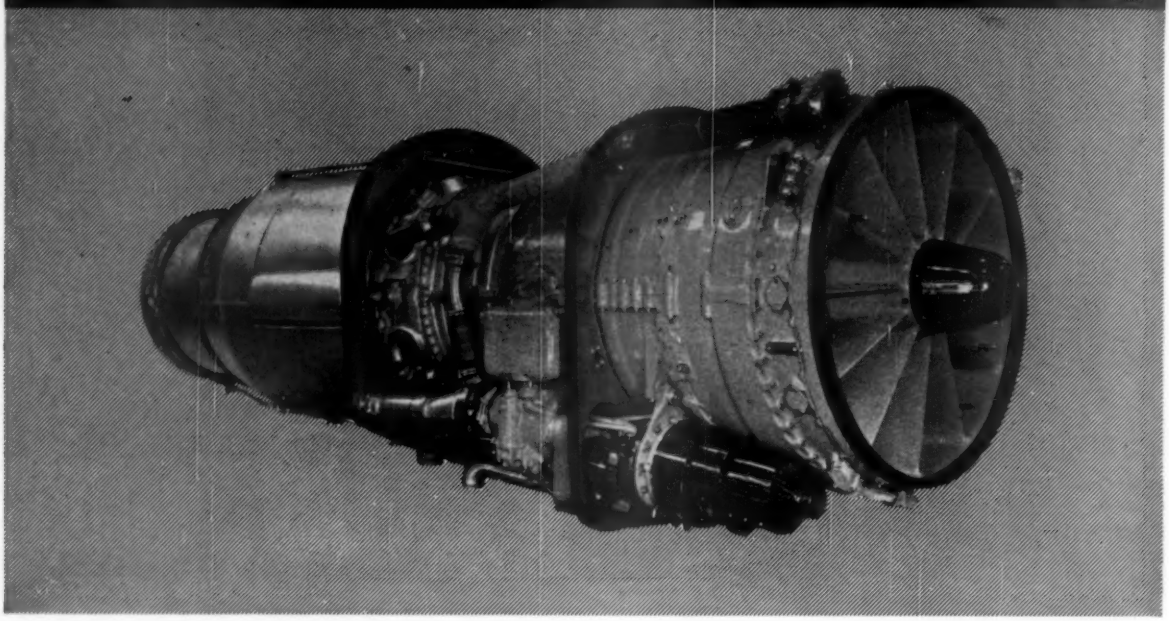
It is entirely self-contained yet flushes normally and is *odourless*. It can be lifted out and replaced with a fresh unit in about three minutes and requires no ground equipment. It weighs only 26 lb. yet is stainless steel throughout and is interchangeable with existing units. Full details?

Please contact us if we can assist you.

Delaney Gallay LTD

VULCAN WORKS, EDGWARE ROAD, LONDON, N.W.2. Telephone: GLAdstone 2201

Latest Olympus version – ready for production – produces 20,000-lb thrust dry...



...ANOTHER ENGINEERING ADVANCE BY BRISTOL SIDDELEY

Security restrictions have just been lifted to permit the release of some details of the current Olympus version, the 21, which is now ready for production.

157-in long and with a 42-in intake diameter, the Bristol Siddeley Olympus 21 is Britain's most powerful military aero-engine. It inherits all the outstanding qualities of its forebears—high power at high altitude, unequalled handling characteristics, low fuel consumption and great operational flexibility. It also possesses the highest thrust/weight ratio of any high-thrust turbojet in the world.

The Olympus series of engines owes its excellent all-round performance to the two-spool compressor system, pioneered by Bristol Siddeley and since adopted by the leading aero-engine producers in Britain and the USA. Proof of Olympus reliability is given by the fact that it has the *longest achieved overhaul life*, the *lowest specific fuel consumption* and the *highest thrust* of any bomber or fighter engine in squadron service with the RAF.

The enormous development potential of the Olympus has repeatedly been proved. The first production version delivered 11,000-lb thrust dry, the current Olympus 21 has reached 20,000 lb, and an even later version is rated at no less than 33,000 lb with reheat.

Olympus applications

The Olympus 201 already gives the Avro Vulcan B 2, spearhead of the RAF's V-bomber force, an all-round performance unsurpassed by any other aircraft of its type. The Olympus 21 has been designed to allow the Vulcan to reach its ultimate design potentialities.

The Bristol Siddeley Olympus is ideally suited to operation at transonic speeds and an advanced version has been selected to power the British Aircraft Corporation's TSR 2, a new tactical support/reconnaissance aircraft chosen for the RAF. Other Olympus versions are under active consideration for the next generation of civil airliners—the supersonic transports.

BRISTOL SIDDELEY ENGINES LIMITED

Correspondence

Roundfly and the Open Cockpit

AS the only paediatrician in Littleton, N.H., qualified on Moths through Vampires, may I express distaste at your use of the expression RUNDFLUG in the editorial of May 27. Why not say roundfly? Feel free, sir, to rundflug Germany at will, but not, pray, Britain.

In regard to other aspects of your estimable journal, let me say how charming it is to read in the appraisal of the S.E.5 the wonder expressed by the test pilot that rudder may actually help initiate a turn. Is it not difficult to remember that it is quite possible to be unfamiliar with the joys of the open cockpit?

Further to this, let me say that alas! sport flying *n'existe plus* here. It is almost all high-wing tedium from A to B, and, very nearly without exception, the aircraft are not stressed for anything more exhilarating than the steep turn.

New Hampshire, U.S.A. W. G. MACKENZIE HUME.

First R.A.F. Halton Reunion—Wren

WITH reference to the splendid cartoon by Wren reporting the Halton Reunion (Jne. 24 last), the references to both Robbie Barton as the *first* Wing Commander and Leslie Hollinghurst as the *first* Adjutant are incorrect. Joe Kilner was the first Wing Commander and Freddie Laurence the first Adjutant. I hope I may be forgiven for getting this particular piece of history on to the record.

Holywood, Co. Down. R. CHEVALIER PRESTON.

Too Low to be True?

I WOULD draw your attention to two apparent errors on page 9 of your Jly. 1 issue.

The Caravelle may well be a very good aircraft, but I cannot believe that departure delays (presumably you mean engineering delays) are as low as you state. Seven delays per 100 departures would be good considering the relatively short time this aircraft has been in service, but seven delays per 1,000 departures represents a far lower level than has ever before been achieved, and frankly I do not believe it!

The figure for the premature engine removal rate should presumably read 0.29 per 1,000 engine hours. As such, it is not remarkable.

Bristol, 6. N. H. WOOD.

[The figures queried by our correspondent were provided by the manufacturers, Sud-Aviation, and their comment is being sought. We have yet to get comparative figures from the Corporations.—ED.]

Why Not The Lightning?

THE report that the R.C.A.F. intends to purchase 60 McDonnell F-101 Voodoo all-weather fighters to fill the gap left by the cancellation of the delta-winged Avro (Canada) Arrow is distressing, not only because Canada is dealing with the U.S.A., but because Great Britain can offer a newer and to my mind a finer fighter—I speak, of course, about the English Electric Lightning F.1.

This aircraft has been offered (with negative result) to the new Luftwaffe, so why not to our traditional ally? Moreover, a Canadian order for the Lightning would give the British aircraft industry a much needed "shot-in-the-arm."

London, N.W.6. ROBERT CARR.

Total World Production

A GROUP of us in the weights department at Canadair, Ltd., where I work, were discussing aircraft production and the question arose: "What is the total World production since the first flight of the Wright Brothers?"

There have been many guesses varying from one to 5.5 million.

We would appreciate any information on this subject that can be given.

Montreal, P.Q., Canada. N. E. PRISSINOTTI.

[We are not sure whether Mr. Prissinotti and his friends are interested in pounds weight or pounds sterling (or equivalent dollar value). Some years ago the late Sir Richard Fairey gave some interesting figures in a paper before the Royal Aeronautical Society.—ED.]

Wroundabout

The Old One-Two . . . Bob Mansfield, Boeing's London PRO, was quick on the draw after seeing my mathematical Wrendering (*Wroundabout, Jly. 8*) of their statement that 707s daily carry 25,000 passengers 400,000 miles, an average journey, I logically figured, of 16 miles per passenger. This played right into Bob's hand. "Your conclusion is not strictly accurate," he says, "every passenger does actually fly the full journey but such is the 707's smooth speed and somnolent silence that the trip just *seems* to be a mere 16 miles."

*

Soar Point. Like power flying, gliding can be more hazardous on the ground than in the air. The birdmen's latest snag is strip-grazing (grazing, not gazing—nothing to do with vertical take-off). These pastoral strips, which are divided by fences—usually comprising a single strand of electrified wire slung between posts—are normally 50 to 60 feet wide. If the wind direction is right, this suits the standard 15-metre class very well but poses interesting problems for the wider glider such as the Olympia 419, Slingsby Eagle and Skylark 3 which span 60 feet or more. For Cdr. Nick Goodhart, R.N., soaring maestro and originator of the mirror-light deck-landing system, this looks like a made-to-measure challenge.

*

Fuellish Operation. If you're not careful, you can be hoist with your own slogan. Remember how TWA. eager to get on the jet wagon, even before their jetliners were available, gave the name "Jet-Stream" to their Lockheed 1649 piston jobs? Well, it caught up with them when a "Jet-Stream" called at Calcutta's Santa Cruz airport the other day. Before anyone could stop them, a jet-conditioned fuelling crew filled half the tanks with kerosene.

*

Requiem. A War-time story has been remembered in the S.A.C. publication *Combat Crew*. Rivalry between American squadrons stationed in England was manifested in "raids" on each other's airfields. On one such raid, a well-filled sack of manure was dropped. When a return raid was launched next day, everyone scattered, expecting a reprisal in kind. Instead, a typewritten sheet floated down. It read: "We regret to inform you that your commanding officer fell to his death on our airfield yesterday while carrying out a bombing mission. We share your grief and await the arrival of a representative to claim the body."

by Wren

Industry Record

Analogue-Digital Computer

Redifon, Ltd., of Crawley, have developed electronic computing and data handling equipment combining both analogue and digital computing techniques. The new computing equipment, called RADIC (Redifon Analogue-Digital Computing System), has been designed for general-purpose use as a system rather than a fixed size computer.

It is claimed to be the first of its kind specifically developed to integrate effectively the stability, convenient input/output equipment and extensive storage facilities of the digital machine with the speed of operation and ease of programming of the analogue. Cost of the RADIC system will range from about £10,000, but it can be expanded if required into a large computing system costing up to £150,000.

A major field of possible application for this new equipment will be the analysis and computation necessary for designing automatic process control apparatus for various complex industrial processes such as may be found in the aircraft and nuclear industries.

A Goodyear Order

Trans-Canada Air Lines has specified Goodyear tyres, wheels, brakes and anti-skid equipment for the 23 Vanguards it has on order from the British Aircraft Corporation. Special arrangements have been made for the wheels and brakes to be manufactured by Goodyear in the United States, and the tyres and anti-skid equipment to be supplied by the Goodyear company in Great Britain. In fact, there is a tripartite Goodyear interest in this order, for the after-sales service is to be furnished by Goodyear's Canadian company in conjunction with the American and British companies.

A New Elliott Computer

From Elliott-Automation Ltd., comes an announcement of a new digital computer, the Elliott 503. This unit incorporates the new ultra-high-speed switching techniques recently announced by Elliott-Automation. According to the company it has a switching time of only 5 milli-micro seconds, and is one of the fastest computers to be marketed anywhere.

A complete Computer System for the 503 is being produced. It incorporates an unlimited extension of the storage facilities by means of new high-speed magnetic tape storage units as well as a wide range of input and output equipment and special keyboards for the running of parallel programmes. The capacity of the new computer is such that, by time-sharing, it will be possible to undertake a number of different jobs simultaneously.

A full range of automatic programming routines, including internationally agreed autocoding systems, will be available for the new computer. They are fully compatible with those now available for other types of Elliott computers.

U.S. Tools from Scotland

Starrett tools and measuring instruments will soon be available from L. S. Starrett Co., Ltd., at Jedburgh; this is a U.K. subsidiary set up by the American company of that name of Athol, Massachusetts. The ultra-modern factory at Jedburgh, Roxburghshire, covering an area of over 75,000 square feet, has already begun production of Starrett bandsaw blades. One milling machine alone is said to be capable of producing 62,000 ft. of bandsaw blade each week.

It will be a year or so before full production of measuring tools and other precision instruments is attained.

Non-destructive Testing

A conference on the "Theory and Practice of Ultrasonic Inspection" is to be held at Queens Hotel, Cheltenham, during the period Sept. 22-24, 1960. The arrangements are being made jointly by the Institute of Physics' Non-Destructive Testing Group; the Society of Non-Destructive Examination; and the Non-Destructive Testing Society of Great Britain.

Further details of the programme can be obtained from the Conference Secretary, Mr. I. M. Barnes, Materials Laboratory, de Havilland Propellers, Ltd., Hatfield, Herts.

Filters for the Lightning

Palmer Aero Products, Ltd., have been awarded a contract to supply three types of filters for use on the English Electric Lightning. The three types have been specially developed for the aircraft and all have Parmesh stainless steel elements for filtering DTD 585 hydraulic oil.

The first type is a 1¼-Imp. g.p.m. unit working at 3,000 p.s.i. with an operating temperature range of −55° C. to 100° C.+. The degree of filtration is 10 microns absolute. These filters are for the autostabilizer and feel unit systems. Second of these filters is a 5-Imp. g.p.m. by-pass unit operating at 500 p.s.i. and the third is a 7½-Imp. g.p.m. filter working at 3,100 p.s.i. Both of these have the same temperature range and degree of filtration as the first type.

PUBLICATIONS RECEIVED

Beyond the Planet Earth.—A space-fiction account of a journey into outer space by a manned rocket, written in 1920 by the Soviet pioneer of space research, Konstantin Tsiolkovsky. Translated by Kenneth Syers. 190 pp., 4¾ in. by 7¼ in. Pergamon Press. 15s.

Ballistic and Guided Missiles.—Types of missiles and their War-time and peace-time uses described in The Mechanical Age Library series of books for young enthusiasts. By Adrian Ball. 144 pp., 4¾ in. by 7¼ in. Frederick Muller, Ltd. 9s. 6d.

Practical Welding Repairs. A reference book for repair welders covering the repair of castings and sheet metal and the re-building of worn parts. By C. G. Bainbridge. 128 pp. 5¼ in. by 8¼ in. Illustrated. Temple Press Limited. Price 15s.

Strike from the Sky. An interpretative account of the Battle of Britain, based on British and German records and the personal accounts of many who took part. By Alexander McKee. 288 pp.; 5¼ in. by 8¼ in. Illustrated. Souvenir Press, Ltd. Price 21s.

Kitty Hawk to Sputnik to Polaris. A study of the development of air power as a political force. By Eugene E. Wilson. 250 pp.; 6¼ in. by 9¼ in. Published by Barre Gazette, South Street, Barre, Massachusetts. Price $5.00.

Jet Planes Work Like This. Second edition, fully revised, of a book for young people in the "Science Works Like This" series. By John W. R. Taylor. 64 pp.; 6¼ in. by 10 in. Illustrated. Phoenix House, Ltd. Price 9s. 6d.

Hydraulic Oils. A handbook. 74 pp.; 5¼ in. by 8¼ in. Illustrated. Free on request to Wakefield-Dick Industrial Oils, Ltd., Castrol House, Marylebone Road, London, N.W.1.

Aviation Calendar

Jly. 23

Odiham.—Inter-Service Gliding week; until Aug. 1.

Lossiemouth.—R.N. Air Station "Air Day," organized by the Fleet Air Arm.

Middle Wallop.—Army Air Corps Open Day and Flying Display.

Jly. 24

Sutton Bank.—Gliding Week, organized by the Yorkshire Gliding Club.

Dunstable.—Gliding week, organized by the London Gliding Club.

Camphill.—Gliding week, organized by the Derby and Lancashire Gliding Club.

Jly. 30

Lasham.—Gliding week, organized by the Inter-Services Gliding Club; until Aug. 7.

Jly. 31

Mousticheve, nr. Sofia.—World Parachuting Championships, organized by the Bulgarian Aero Club.

Aug. 1

Chobham.—Air Display by the Tiger Club at Fair Oaks Aerodrome.

Aug. 3

London.—Polish Official Film of the 1958 World Gliding Championships at the Kronfeld Club, 74 Basement, Eccleston Square, S.W.1, at 20.00 hrs.

Aug. 8-11

Seattle, Washington.—Western National Meeting of the American Astronautical Society at the Olympic Hotel.

New Patents

APPLICATIONS ACCEPTED

846,246.—**Brevets Aero-Mecaniques S.A.**—"Rockets carried in clusters by a launching machine and in particular by an aircraft."—Aug. 13, 1958 (Aug. 27, 1957).

846,382.—**English Electric Co., Ltd.**—"Aircraft."—Jan. 4, 1957 (Jan. 11, 1956).

846,322.—**Australia, Commonwealth of.**—"Lift augmenting means."—Aug. 22, 1957 (Aug. 24, 1956).

846,300.—**Boulton Paul Aircraft, Ltd.,** and **Armstrong Siddeley Motors, Ltd.**—"Aircraft."—Jly. 2, 1957 (Apr. 17, 1956).

846,703.—**Rolls-Royce, Ltd.,** and **Mathers, J. H.**—"Aircraft controls."—Sept. 23, 1957 (Oct. 5, 1956).

846,372.—**Garret Corporation.**—"Collapsible escape chute."—Sept. 30, 1958 (Sept. 30, 1957).

Printed specifications of the above will be available on Aug. 31, 1960, and the opposition period will expire on Nov. 30, 1960.

Personal Notices

BIRTHS

Coombs.—On Jly. 6, at R.A.F. Hospital, Wroughton, to Jacqueline (*née* Hunter-Watts), wife of Flt. Lt. C. John Coombs—a son.

Cunnington.—On Jly. 6, at Nordsee Klinik, Sylt, B.R.P.O. 46, to Oriel (*née* West), wife of Flt. Lt. G. H. Cunnington—a daughter.

David.—On Jly. 4, at Highfield Maternity Home, Barnstaple, to Rosemary (*née* Summerfield), wife of Flt. Lt. R. J. M. David—a son.

Lawrence.—On Jly. 3, at P.M. R.A.F. Hospital, Halton, to Jean (*née* Davidson), wife of Flt. Lt. V. J. W. M. Lawrence—a son.

Plumb.—On Jly. 3, to Anne (*née* Harvey), wife of Flt. Lt. R. A. Plumb—a daughter.

Rogers.—On Jly. 2, at Louth and District Hospital, to Jean, wife of Flt. Lt. Peter Rogers—a son.

Shirley.—On Jly. 6, at Buxton, to Joan (*née* Edmondson), wife of Flg. Off. M. J. Shirley—a daughter.

DEATHS

Hodson.—On Jly. 5, Air Vice-Marshal Keith L. B. Hodson, R.C.A.F.

Kaye.—On Jly. 7, Flt. Lt. Zen Kaye.

Maxwell.—On Jly. 1, Gp. Capt. Reginald Stuart Maxwell, M.C., D.S.C., A.S.C.

Moody.—On Jly. 6, Admiral Sir Clement Moody, K.C.B.

White.—On Jly. 7, Flt. Lt. Malcolm B. White.

Jet Provost

Powered by the Bristol Siddeley Viper

in service with the Royal Air Force

With pride we announce the continuing exclusive use of HUNTING designed and manufactured primary/basic trainers in the Royal Air Force.

After the most thorough evaluation ever given to any training aircraft, the Jet Provost T.Mk.3. is now in operation at Royal Air Force Basic Flying Training Schools.

Similar to the T.Mk.3. but fitted with armament in addition, the Jet Provost T.Mk.51. is in service with the Royal Ceylon Air Force.

HUNTING AIRCRAFT LIMITED

Member Company of British Aircraft Corporation

LUTON AIRPORT, BEDFORDSHIRE, ENGLAND

AP390

over 260 meals per flight

ON B·O·A·C BOEING 707's

prepared in G.E.C. equipped twin-galleys

Faster flight times demand quicker than ever meals service on the world's biggest and fastest jetliners.
To achieve this and to supply 129 passengers with two meals each, B.O.A.C.'s new aircraft have two G.E.C. equipped galleys operated by a staff of six.
Each galley has two air-circulation ovens, three hot beverage containers and two hotcups. Six course lunches or dinners are served, followed by a second lighter meal.
B.O.A.C. is one of 106 aircraft operators, including Aeroflot, who use airborne catering equipment by G.E.C.—by far the world's largest and most experienced suppliers of this type of equipment.

G.E.C.

ELECTRICAL EQUIPMENT FOR AVIATION—in the air—on the ground

The General Electric Company Limited, Magnet House, Kingsway, London, W.C.2

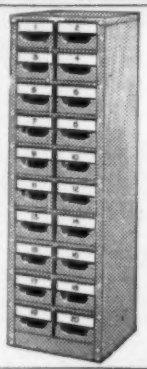
HANDY DRAWER UNIT

42" high × 13" wide × 12" deep.
23 drawers as illustrated.
ONLY **£7 15s. 0d.**
IMMEDIATE **FREE** DELIVERY

Each drawer
5" wide × 3" high × 11½" long.

★ Heavy gauge steel, stove enamelled dark green.
★ Write now for list of other sizes.

ROCHDALE METAL PRODUCTS
Devon Street Works
Tel.: ROCHDALE 40078



The 172

Cessna

SOLE DISTRIBUTORS IN GREAT BRITAIN ARE
AIRWORK SERVICES
35 PICCADILLY W.1. REG 8494

MARSHALL
AIRPORT WORKS CAMBRIDGE
require
DRAUGHTSMEN
Electrical, Structural
and
Instrumental
for work on modification, trial installation and development work on modern aircraft.
Good starting salaries with housing assistance for suitably qualified applicants.
Apply in writing, giving full details of experience and convenient dates for interview to:—
PERSONNEL MANAGER

Hawker Siddeley Aviation
LIMITED

vacancies in

PERFORMANCE & SALES ENGINEERING

on the new successful

AVRO 748 TURBO PROP AIRLINER

There are a limited number of senior and junior vacancies for personnel in the Performance and Sales Engineering groups of A. V. ROE & CO. LTD.

The work is connected with Performance Analysis, Route Studies, Market Survey, Operational Costs and Preparation of Flight Performance manuals.

Applicants should have some previous experience and be prepared to travel.

Apply giving general particulars of age, qualifications and experience to:—

The Personnel Manager,

A. V. ROE & CO. LIMITED, Greengate, Middleton, Manchester

THE AEROPLANE and ASTRONAUTICS

CLASSIFIED ADVERTISEMENTS

PRESS DAY: First Post, THURSDAY

RATE: 1/- per word (minimum 12 words 12/-).

AIRCRAFT FOR SALE

W. S. SHACKLETON, LTD.,

EUROPE'S LEADING AIRCRAFT BROKERS.

WITH American light aeroplanes entering the country in a steady flow we are able to offer a wider selection of used British aircraft. Some Gemini's for example are the following:—

REFERENCE 2938. Cirrus Minor 2 engines, airframe 1,012, engines nil and 304 s.c.o., C. of A. private, May 27, 1962, Plessey PTR61H VHF, £1,450.

REFERENCE 2944. Cirrus Minor 2 engines, airframe 1,725, engines 340 and 325 s.c.o., C. of A. public transport, April 7, 1961, CE1140 VHF, £2,500.

REFERENCE 2939. Cirrus Minor 2 engines, airframe 790, engines 198 and 195 s.c.o., C. of A. private, March 28, 1963, dual control, Murphy MR100B VHF, Murphy MR70 MF, BC1033 fan marker receiver, £2,300.

REFERENCE 2936. Cirrus Minor 2 engines, airframe 2670, engines 473 and 451 s.c.o., C. of A. private, March 11, 1962, dual control, Murphy MR80 VHF, £2,000.

REFERENCE 2542. Cirrus Minor 2 engines, airframe 1,681, engines 278 and 277 s.c.o., C. of A. public transport, February 15, 1961 £1,350.

REFERENCE 2559. Cirrus Minor 2 engines, airframe 2106, engines 155 and 255 s.c.o., C. of A. public transport 12 months from date of delivery, Murphy MR100 VHF, £2,150.

REFERENCE 2930. Cirrus Minor 2A engines (800-hour overhaul life), airframe 2,001, engines 505 and 505 s.c.o., C. of A. private, expires 28.4.63, Murphy MR80 VHF, £2,100.

REFERENCE 2532. Cirrus Minor 2 engines, airframe 1,093, engines 506 and 218 s.c.o., C. of A. private, June 3, 1963, dual controls, Plessey PTR61 VHF, £2,100.

W. S. SHACKLETON, LTD., 175 Piccadilly, London, W.1. Phone, Hyde Park 2448 9. Cable, "Shackhud, London." 544-13

CIRRUS IIA Gemini, fitted with dual control, landing lights, radio, 3-year C. of A., any reasonable offer accepted as hangar space urgently required. TWO Cirrus Minor IIA engines for sale, completely overhauled by makers. Box A421, care of THE AEROPLANE AND ASTRONAUTICS. 544-9024

PBY 5A.

TWO AMPHIBIANS CONVERTED FOR TWO-CREW CARGO-PASSENGER USE.

BOX A404,

Care of THE AEROPLANE AND ASTRONAUTICS. 544-11

AUSTER J4, new engine, new C. of A., long-range tank, resprayed, in nice condition, £900.

AUSTER I, Taylorcraft, 600 hours to run, new C. of A., respray, new upholstery, £750.

HORNET MOTH, in nice condition, 1,000 to go on engine, aluminium heads, £650.

NIGHTSCALE, Littlewick Green 273. 544-9027

ROLLASONS pay full P.P.L. course at club of your choice when you contract to buy a Jodel. For details of this and of the Turbulent and rebuilt Tiger Moths, phone Croydon 5151, or write Rollason Aircraft and Engines, Ltd., Croydon Airport. zzz-753

PETER CLIFFORD AND CO.,

OFFER

MID-SEASON BARGAINS

MILES Gemini 1A Cirrus Minor IIs, port 3 hrs., starboard 309, airframe 1,014 hrs., since certificate of airworthiness 28 hrs., fitted solo controls, blind flying panel, Plessey 6-channel V.H.F. with 23 set of crystals, certificate of airworthiness expires 27.5.62, £1,450.

MILES Messenger 11A Cirrus Major III 329 hrs. airframe 829 hrs. since certificate of airworthiness 163 hrs., fitted solo controls, blind flying panel, Ekco 4-channel V.H.F., certificate of airworthiness expires 8.3.61, £1,250.

FURTHER details on request. Tresa, Kirtlington, near Oxford. Phone, Kidlington 3081, Ettington 238. 544-5

AUSTER Autocrat 3-seater with reconditioned Cirrus Minor II engine, certificate of airworthiness plus respray just completed, privately owned and in excellent condition. Great Barford 223, Bedfordshire, during day. 544-2

EXECUTIVE

DE HAVILLAND DOVE,

TOTAL TIME 1,146 HR.

BOX A403,

Care of THE AEROPLANE AND ASTRONAUTICS. 544-10

FOUR D.H. Dove Mk. 1B, full airline standard, excellent condition, available immediately from £9,000. Channel Airways, Southend Airport, Essex. Phone, Rochford 56460. 544-9

AERO 145

IDEAL FOR PRIVATE AND BUSINESS USERS

The latest improved version of the world renowned SUPER AERO 45, now powered by 140 h.p. Walter M 332 engines with manually controlled superchargers and direct fuel injection. Attractive twin-engined 4-seat aircraft capable of 940 miles range cruising at 160 m.p.h. with a fuel consumption of less than 11 gallons per hour.

★ SAFETY — Outstanding single-engined performance provided by the more powerful engines in conjunction with variable pitch, fully feathering propellers. Carburettor icing eliminated.

★ ECONOMY — The finest value in the world today. Lowest first cost and lowest operating costs in its class.

★ COMFORT — Delightful to fly. Quiet, well furnished cabin with ample luggage accommodation.

Early delivery. 24-hours spare parts service and full maintenance backing available in the U.K.

Sole U.K. distributor for OMNIPOL, Prague.

Group Captain EDWARD MOLE,
Aircraft & General Finance Corporation Ltd.,
3 Red Place, Green Street, London, W.1
Tel.: Grosvenor 4360. Cables: EMAVIAT, London

PIAGGIO *of GENOA*

5 popular P.166 Executives have been bought by British business flyers during the first year that it has been in production

British Representatives

AERO-ENTERPRISES
(Boreham Wood) Ltd.
17 Dunstable Rd., Boreham Wood, Herts. ELS 2888

PIPER TRI-PACER 160

VIGORS FOR PIPERS
KIDLINGTON 3444/5 OXFORD

R. K. DUNDAS, LTD.,

BUY YOUR PLANE FROM US OR WE BOTH LOSE MONEY.

HERE, available in U.K., are the following fine used American light aircraft, all in immaculate condition at prices unapproachable. Inspection and demonstration gladly arranged.

SUPER CUSTOM TRIPACER, 1956, 50 hrs. S.M.O.H. on engine, 50 hrs. since British C. of A., airframe thoroughly overhauled, including all instruments, Narco S.implexer and VOR., Lear ADF-12E, auxiliary tank, nine chromated throughout, painted turquoise and white, with turquoise and charcoal matching interior, this aeroplane is as new, £3,595.

SUPER CUSTOM TRIPACER, 1957, nil hours S.M.O.H. on engine, completely overhauled airframe and instruments, all new covering and paint job, painted blue and white with matching interior and new carpets, new Narco VHT-3 Super homer, new C. of A. This aeroplane is a showpiece, £3,745.

SUPER CUSTOM TRIPACER, 1955, 1,094 hrs. total, 49 hrs. engine, new C. of A., full gyros, dual, night flying, Lear LTRA-6, VHF, ILS/VOR, in really lovely condition, red and white with like-new red-black interior, £2,995.

SUPER CUSTOM TRIPACER, 1958, 1,328 hrs. total time, 184 hrs. engine, new C. of A., full gyros, dual, night flying, Narco VHT-3 Superhomer, VOR/ILS. This aeroplane is like new and immaculate inside and out, £3,595.

THIS WEEK'S BARGAIN:—

CESSNA 170B de luxe, all-metal modified tricycle gear, disc brakes, full panel, new C. of A., less than approximately 400 hrs. engine, Goodyear cross-wind gear, many extras. This is superbly quiet, smooth, very well equipped with Lear 12-channel VHF with tunable receiver from 108-127 Mcs, VOR Omniscope, 2-band LF Range and broadcast Rec., mike headsets, 24 crystals, full night flying, sunvisors, beige and blue interior carpets and seats, painted red-silver Cessna design, only £2,995.

R. K. DUNDAS, LTD., Dundas House, 59 Saint James's St., London, S.W.1. Phone, Hyde Park 3717. Cables, "Dundas, Piccy, London." 544-19

AUSTER Auto raft, full panel, long-range tank, three years C. of A. just completed, £1,400. Contact Hunt (Textiles), Ltd., Scarborough. 544-x6943

Aircraft Wanted

SCRAP aircraft aluminium and stainless steel urgently required. Lowton Metals, Ltd., Lowton St. Mary's, near Warrington. Leigh 1444-5. zzz-711

AIRCRAFT ACCESSORIES, SPARES AND COMPONENTS

THE REGIONAL AIR TRADING CO., Croydon Airport, for Rapide spares of every description. Phone, Croydon 8521. zzz-714

PHILLIPS AND WHITE, LTD.

THE leading stockists in the U.K. for: Instruments, navigational equipment, electrical components and parts, and engine accessories. Spares for de Havilland Gipsy Major and Queen series and Armstrong Siddeley Cheetah IX, X and XV engines.

61 QUEEN'S GARDENS, London, W.2. Phone, Ambassador 8651, 2764. Cables, "Gyrair London." zzz-748

REPAIRCRAFT, LTD., The Common, Cranleigh, Surrey (Cranleigh 536), for instrument and auto-pilot overhaul. zzz-749

ROLLASONS for Tiger Moth spares and for Gipsy engine overhauls and spares. Croydon 5151. zzz-754

AIRFRAME spares for Dakotas, Harvards, Piper Cub, Fairchilds, Argus, Beechcraft, D-17s, Mosquito, Spitfire, Firefly. Engine spares for Pratt & Whitney, Armstrong Siddeley, Lycoming, etc., accessories and instruments for all types of aircraft.

C.47 Dakota operators please note, we offer a limited number of genuine brand-new Bendix 52058 tail wheels at a reasonable price.

A. J. WALTER, LTD., The Drive, Horley, Surrey. Phone, Horley 1420 and 4294. Cables, "Cubeng, Horley." 544-17

Aircraft Accessories, Spares and Components Wanted

TRADAIR, LTD., urgently require ground starter unit suitable for Viscount aircraft, must be diesel-engined and supply 2,000 amps. at 28 volts. Unit requiring overhaul considered. Full details to Supplies Manager, Tradair, Ltd., Southend Airport, Essex. 546-9035

HELICOPTERS

HELICOPTERS SERVICES, LTD., offer their aircraft for all charter services. 96 Piccadilly, London, W.1. Gro 5493-6. zzz-756

LINK TRAINERS

LINK Trainer D4 and spares wanted. Offers invited. Box A441, care of THE AEROPLANE AND ASTRONAUTICS. 544-7

CLOTHING

R.A.F. Officers' uniforms for sale, new and reconditioned. Fisher's, 86-88 Wellington St., Woolwich. Phone 1055. Kit also purchased. zzz-721

CONSULTANTS

R. H. STOCKEN, F.R.Ae.S., Eagle House, 109 Jermyn St., S.W.1. Whitehall 2777-9. zzz-743

IAN L. S. McNICOL, London School of Air Navigation. Pilot and navigator training with advisory service. 33 Ovington Square, Knightsbridge, S.W.3. Ken 6823. zzz-746

R. W. SUTTON (CONSULTANTS), LTD., 7 Lansdown Place, Cheltenham. Phone 5811. 547-8985

NOTICES

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM DAN-AIR SERVICES, LTD., OF 36-38 NEW BROAD STREET, LONDON, E.C.2, for the following U.K. Internal Services with Dove, Dakota, Bristol and Ambassador aircraft for the carriage of passengers, supplementary freight and mail at a frequency of four return flights weekly on each service from seven years from date of approval:—

APPLICATION NO. 4400 between Newcastle and Dundee.

APPLICATION NO. 4401 between London (Gatwick) and Dundee.

APPLICATION NO. 4402 between Liverpool and Dundee.

FROM SKYWAYS COACH AIR, LTD., OF 7 BERKELEY STREET, LONDON, W.1, for the following normal scheduled services with Dakota, Avro 748, Constellation 749 and Hermes aircraft for the carriage of passengers, supplementary freight and mail at a frequency except where otherwise stated of seven return flights weekly rising later to 35 return flights weekly from April 1 to October 31 each year for 10 years from April, 1961:—

(a) APPLICATION NO. 4397 on the route Lympne or Manston-Lyons-Albenga.

(b) APPLICATION NO. 4396 on the route Lympne or Manston-Lyons-Frejus.

(c) APPLICATION NO. 4395 on the route Lympne or Manston-Antwerp at a frequency of two return flights daily throughout the year.

FROM EAST ANGLIAN FLYING SERVICES, LTD., OF SOUTHEND AIRPORT, ESSEX:—

APPLICATION NO. 452/5 for an amendment to the terms of approval of the normal scheduled service which they are authorized to operate with DH.89, Dove, Heron, Bristol 170 and Viking aircraft on the route Ipswich and/or Southend-Rotterdam at a maximum frequency of 30 return flights weekly subject to a weekly passenger capacity not exceeding 854 seats until July 7, 1962, so as to enable them to operate at a frequency according to traffic demand and with Viscount aircraft in addition to the types already approved.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 544-3

MINISTRY OF EDUCATION

NOTICE

THE COLLEGE OF AERONAUTICS

NOTICE is hereby given that the Minister of Education proposes after the expiration of one calendar month to establish a SCHEME under the Charitable Trusts Acts for the above Foundation.

The proposed scheme may be inspected on any weekday (except Saturday) during 21 days from this date between 10 a.m. and 4 p.m. at the office of the Governing Body of the College at 58 Victoria Street, London, S.W.1. Copies can be obtained at the Ministry of Education, Curzon Street, London, W.1. Objections or suggestions may be sent in writing within one calendar month from this date to

THE SECRETARY,
MINISTRY OF EDUCATION,
LEGAL BRANCH,
CURZON STREET, LONDON, W.1,

quoting the following reference number T403/8270/8/87 dated July 22, 1960. 544-4

CRACK DETECTION

UNUSED American Magnaflux crack detector, complete and in perfect condition. View Forklifts (Buricigh of Wembley), Ltd., Alpine Works, Empire Way, Wembley 0211. 547-9037

HIRE AND CHARTER

RAPIDES for hire and charter. A. J. Whittemore (Aeradio), Ltd., Biggin Hill Aerodrome, Kent. zzz-0731

VICKERS Viscounts for charter. W. S. Shackleton, Ltd., 175 Piccadilly, London, W.1. 544-16

HIRE-PURCHASE

BORROW money on your aeroplane. We will purchase your machine and sell it back to you on hire-purchase over two years. Raymond Way Motors, Ltd., Kilburn, London, N.W.6. 547-9032

PACKING AND SHIPPING

R. AND J. PARK, LTD., 143-9 Fenchurch St., E.C.3. Phone, Mansion House 3089. Official packers and shippers to the aircraft industry. zzz-674

RADIO AND RADAR

SPERRY ZERO reader. Type ZLI course selectors, control panels, flight computers and indicators, three complete installations in stock. A. J. Whittemore (Aeradio), Ltd., Biggin Hill Aerodrome, Kent. zzz-0729

STR12D, STR9Z, STR9X and most other British and American VHF R/T equipment always in stock. A.R.B.-approved design installations into any type of aircraft. A. J. Whittemore (Aeradio), Ltd., Biggin Hill Aerodrome, Kent. zzz-0730

RADAR height-finding cabins, type 13/6, practically complete. Offers required. Box A011, care of THE AEROPLANE AND ASTRONAUTICS. zz-718

SITUATIONS VACANT

A.F.R.Ae.S., A.R.B.Certs., A.M.I.Mech.E., etc., on "no pass, no fee" terms. Over 95% successes. For details of exams and courses in all branches of aeronautical work, aero engines, mechanical engineering, etc., write for 148-page handbook—free—B.I.E.T. (Dept. 703), 29 Wrights Lane, London, W.8. zzz-740

HAWKER SIDDELEY AVIATION, LTD.
FOLLAND AIRCRAFT, LTD.

OF HAMBLE,

INVITE APPLICATIONS FOR THE FOLLOWING APPOINTMENT.

SENIOR PROJECT AERODYNAMICIST.

A senior aerodynamicist is required for advanced project studies on aircraft, hovercraft, and other airborne vehicles.

Applicants should have experience in aerodynamics and thermodynamics, possess a degree or equivalent qualification, with a minimum of three years' experience.

The appointment offers senior staff status, with commensurate salary, generous conditions of employment, superannuation, and excellent social and welfare facilities in a pleasant South Coast area.

Applications to:—
THE PERSONNEL MANAGER:—
FOLLAND AIRCRAFT, LTD.,
(HAWKER SIDDELEY AVIATION, LTD.),
HAMBLE, NEAR SOUTHAMPTON.
Phone, Hamble 3371. 546-9034

EAGLE AIRWAYS (Bermuda) have the following immediate vacancies:
A- And C-licensed engineer Viscount aircraft, based Bermuda, £180-£187 per month.
A- And C-licensed engineer Viscount aircraft, based Miami, $725 per month.
APPLY: Chief Engineer, Eagle Aircraft Services, Ltd., London Airport, Hounslow, Middx. 544-9023

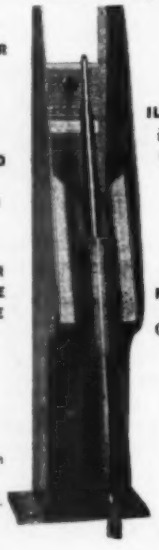
BRITISH UNITED AIRWAYS, LTD., have immediate vacancies for pilots and aircraft engineers for Dakota and Dove aircraft, based overseas. Apply to the Contract Division, British United Airways, Ltd., National Works, Bath Rd., Hounslow, Middx. 544-9028

INTERESTING position offered to suitable applicant as secretary/shorthand-typist to managing director of flying school. Vacancy August 8. Accommodation available at special club rates. Apply, stating qualifications and salary required. The Wiltshire School of Flying, Ltd., Thruxton Aerodrome, Andover, Hants. 545-9031

LICENSED radio/radar engineer to take charge of an aircraft radio maintenance section in Southern England. Good salary and conditions. Box A432, care of THE AEROPLANE AND ASTRONAUTICS. 544-9029

ADCOLA
(Regd. Trade Mark)
SOLDERING EQUIPMENT

THE ELECTRONIC INDUSTRIES SOLDERING TOOL FOR THE TRANSISTOR AGE



ILLUSTRATED
⅛" Bit Model
(Cat: No. 70)

MANUFACTURED IN ALL VOLT RANGES

DESIGNED FOR CONTINUAL USE ON BENCHLINE ASSEMBLY

PROTECTIVE SHIELD
(Cat: No. 68)

British & Foreign Patents Reg. Designs etc.

Catalogues from Head Office, Sales & Service
ADCOLA PRODUCTS LTD.
GAUDEN ROAD, CLAPHAM HIGH STREET, LONDON, SW4
Telephones: MACaulay 3101 & 4272

EXECUTIVE DOVE

★ Just completed overhaul by Fields.
★ Under 2,000 hours since new.
★ Completely refurnished throughout.
★ Low engine hours, new propellers.
★ Twin V.H.F. and A.D.F.
★ Fitted Bar (stocked).
★ Full de-icing.

This almost new aircraft can be either purchased or rented for short periods, or by the year.

Full details on request to:
T. D. Keegan Ltd.
SOUTHEND AIRPORT
SOUTHEND-ON-SEA - - ESSEX

Ministry of Aviation

OPERATIONS OFFICERS

At least 3 posts for men or women of good general education, normally with School Certificate or equivalent, to act as Flight Operations Inspectors. Considerable flying involved. Age at least 23 on 1.9.60. Candidates must have had recent experience as pilot in civil air transport, and have held Airline Transport Pilot's or Senior Commercial Pilot's Licence, but exceptionally, extensive flying and considerable recent experience in other operational fields of aviation may be accepted instead. Preference given to those with Higher School Certificate (or equivalent) with a pass in a mathematical or science subject, or A.F.R.Ae.S. by examination.

Additional advantages: organising experience, knowledge of civil aviation legislation and practice, aerodrome planning, radio and radar aids to navigation, French or Spanish. Salary (men, London) £1,190 (at 31) £1,233 (32 or over) rising to £1,589 plus allowance of £250 p.a. while employed on Flight Operations Inspector duties. During short training period, salary (men, London) will be £761 (at 23) to £1,130 (32 or over) rising to £1,170. Prospects of pensionable employment and promotion.

Write:
CIVIL SERVICE COMMISSION,
Burlington Gardens, London, W.1,
for application form quoting 5171/60.
CLOSING DATE: 2nd SEPTEMBER, 1960.

HAWKER SIDDELEY AVIATION, LTD.
FOLLAND AIRCRAFT, LTD.,
OF HAMBLE.

Invite applications for the following

DESIGN OFFICE APPOINTMENTS:

SENIOR ENGINEER.

A group leader is required to take responsibility for aeroelastic work. The work entails detail analysis on high-speed fighter aircraft and large transport aircraft, together with a wide range of project studies. This is a senor staff position and a degree or equivalent qualification with at least five years' experience would be essential. The applicant should be prepared to actively participate in ground and flight test programmes, and should preferably have knowledge of computor techniques as applied to this subject.

SENIOR AERODYNAMICIST.

A senior man is required for flight test planning and analysis in connection with the flight development programme for the Gnat. This appointment is with our aerodynamics department, and entails active participation in day-to-day operation of the flight test programme. Applicants should have had direct experience of performance and handling flight test procedure and analysis, and also possess a degree or equivalent qualification, with a minimum of three years' experience.

SENIOR STRESSMAN.

A senior man required for comprehensive and interesting programme of work. B.Sc. or equivalent qualification with some years' experience in the stress analysis field. Knowledge of the application of digital computers to the stress analysis sphere would be an advantage.

These appointments are permanent, progressive, and offer senior staff status at salaries commensurate to responsibility qualification and experience. Hawker Siddeley Group Superannuation, with excellent conditions of employment, social and welfare facilities in a pleasant South Coast area.

Applications to the
PERSONNEL MANAGER,
FOLLAND AIRCRAFT, LTD.,
HAMBLE (NEAR SOUTHAMPTON).
Phone, Hamble 3371. 544-1

RADIO engineer (licence A) for maintenance of radio installations in modern civil and military aircraft. Good wages. Apply, Personnel Manager, Marshalls, The Aerodrome, Cambridge. 544-9033

AVIATION DIVISION.
PRESSED STEEL CO., LTD.,
REQUIRES
A AND C LICENSED ENGINEERS
(5.1, 5.2 and 6.1).
ENGINE AND AIRFRAME FITTERS
for assembly and maintenance work on light British and American aircraft.

Apply with full details of experience and qualifications to:—
Chief Engineer,
AVIATION DIVISION,
PRESSED STEEL CO., LTD.,
OXFORD AIRPORT,
KIDLINGTON. 546-9033

TECHNICAL manager required, minimum qualifications Cat. A and C licences covering Turn-engined aircraft; experienced stores, provisioning. Salary £1,100 to £1,600. House provided. Apply Box A442, care of THE AEROPLANE AND ASTRONAUTICS. 544-8

GOVERNMENT OF THE FEDERATION OF RHODESIA AND NYASALAND.

SENIOR TELECOMMUNICATIONS OFFICER (PLANNING).

DEPARTMENT OF CIVIL AVIATION.

APPLICATIONS ARE INVITED FROM PROFESSIONALLY QUALIFIED TELECOMMUNICATIONS ENGINEERS OR FROM ENGINEERS WITH EXCEPTIONAL RELEVANT EXPERIENCE TO FILL THE ABOVE VACANCY.

Candidates should have had experience of civil aeronautical telecommunications including modern navigational aids.

The salary offered is in the range of £1,785-£1,942 10s. per annum or £1,732 10s.-£1,890 per annum, depending on qualifications and experience.

Application forms and further details from:—
THE SECRETARY (R),
RHODESIA HOUSE,
429 STRAND, LONDON, W.C.2.
CLOSING DATE 31.7.60. 544-18

Cranwell trains the R.A.F. leaders of tomorrow

For a few hand-picked men, a unique combination of adventure and responsibility

R.A.F. College, Cranwell trains young men for permanent R.A.F. commissions. Many will be tomorrow's R.A.F. pilots and navigators, some of whom will be the day-after-tomorrow's Commanders-in-Chief. Some study for the Equipment and Secretarial Branches, leading to senior appointments in logistics or administration. The cadet is trained—on University lines—to think objectively, to see that his decisions are carried out, to develop and prove his abilities. As an R.A.F. officer he will have a career which is secure and well paid, and second to none for adventure.

Qualifications: G.C.E. (or equivalent) in English language, mathematics and 3 other subjects (2 at 'A' level), or (until October 1960) the Civil Service Commission written examination; age—17½ to 19½.

For full information write to
Group Captain J. N. Ogle, A.F.C., A.F.M., Air Ministry (AP 726), Adastral House, London, W.C.1.

CROSS PERFECT PRECISION AIRCRAFT SPRING WASHERS
TO B.S. SPECIFICATION 2 SP.47
CROSS MFG. CO. (1938) LTD
COMBE DOWN, BATH. Tel.: Combe Down 3365/8

NEW BALL & ROLLER BEARINGS
Over 5,000,000 in stock
in more than 5,000 types
BRITAIN'S LARGEST STOCKS
WRITE FOR STOCK LISTS
CLAUDE RYE BEARINGS
895-921, FULHAM RD., LONDON, S.W.6
Phone: RENOWN 6174 (EXT. 24) TELEX 23453

A Sealand Aircraft is being reduced to component parts which are offered for sale and include:—

2 Gipsy Queen 70-4 Engines
1 Gipsy Queen 70-3 Engine
2 PD/126/3121/1 Propellers
1 STR 9 V.H.F. Transmitter/Receiver
1 STR 16 H.F. Transmitter/Receiver
A quantity of Engine & Airframe Spares.

Short Bros. & Harland, Ltd.,
The Aerodrome,
ROCHESTER, Kent

CIRCUIT DRAUGHTSMEN	●	Good salaries payable to first-class men, especially with experience of computors and logical diagrams, depending upon qualifications.
DRAUGHTSMEN	●	Mechanical and Electronic Design and Detail Draughtsmen. Good salaries payable to first-class men, depending upon experience and qualifications.
ELECTRONIC AUTHORS	●	H.N.C. standard and A.E.W.E. and A.T.A. 100 Specification required, especially welcome ex-servicemen with experience of Electronics working to A.T.P. Good salaries payable to first-class men, depending upon experience and qualifications.
GENERAL ARTIST	●	With experience of airbrush work and used to preparing finished artwork for the various printing processes. Holiday arrangements respected and first-class salary.
PARTS LISTERS	●	To compile spare parts catalogues, with working knowledge of A.T.A. 100 Specifications.
TECHNICAL ILLUSTRATORS	●	Experience of line and colour for publications. Holiday arrangements respected. First-class salary.
TRACERS	●	Required with experience of electrical circuits to B.S. 530 standards. First-class salaries.

● *All posts qualify for 38½ hour week and three weeks paid holiday after one year's service. Positions available throughout Great Britain.*

APPLY:
(A) Contracts Manager, Technivision Group of Companies, Braywick House, Nr. Maidenhead, Berks

---

By order of the Liquidator L. Halpern, Esq., F.A., re Flight Servicing Co., Ltd. (in vol. liquidation)

LIGHT PLANE SPARES and EQUIPMENT

SIX GIPSY ENGINES

including CHIPMUNK, TIGER, PROCTOR, MILES and RAPIDE SPARES of main planes, legs, seats, clamps, bearings, seals, sundry engine spares and BONDED STORE STOCK. 2 10-ton hydraulic jacks.

THORNHILL 2-TON MOBILE CRANE. AUSTIN THREEWAY VAN.
OFFICE FURNITURE. OLIVETTI TYPEWRITER.

FOR SALE BY TENDER in lots as lying at Biggin Hill Aerodrome, Kent.
Arrangements to view and forms of Tender from

EDWARD SYMMONS & PARTNERS
Felton House, 18/20, York Buildings, Adelphi, London, W.C.2. Telephone: WHI. 8711

AIR CONDOR, LTD., require first officers with commercial licence, I.R. Viking or Bristol endorsement advantage. Bevis Marks House, London, E.C.3. 544-6

RADIO MECHANICS
FOR AIRCRAFT RADIO MAINTENANCE AND OVERHAUL.

RADIO ENGINEERS/INSPECTORS
FOR AIRCRAFT RADIO MAINTENANCE.

AIRCRAFT ELECTRICIANS.
URGENTLY REQUIRED.

Apply:—

EAGLE AIRCRAFT SERVICES, LTD.,
LONDON AIRPORT,
HOUNSLOW, MIDDX. 546-9038

LICENSED radio engineer with A licence and pulse rating required at Stansted Airport to maintain Britannias and DC-6s, good salary offered with opportunity for progress with rapidly expanding company. Please reply Chief Radio Engineer, Southend Airport. Radio mechanics, preferably with aircraft experience, also required. 547-9036

Air Traffic Control Officers

for

MINISTRY OF AVIATION

Age 23 to 35. Good education and recent aircrew or air traffic control experience essential. Salaries: while training £775 to £1,130 according to age; when fully trained approximately £950 at age 25; £1,160 at age 30 or over rising to £1,480.

Promotion prospects

Write Civil Service Commission
Burlington Gardens,
London, W.1

for application form, quoting 5084/60.

QUEEN MARY COLLEGE
(UNIVERSITY OF LONDON).

APPLICATIONS are invited for the post of Lecturer in Mechanical Engineering, tenable October 1, 1960. Salary scale £1,050 x £50 to £1,400 x £75-£1,550 (efficiency bar) x £75-£1,850, plus London Allowance £60, F.S.S.U. participation and family allowance of £50 for each child. Initial salary according to qualifications and experience. Application forms, obtainable from the Registrar, Queen Mary College, Mile End Rd., E.1, to be returned by August 8. 544-15

SITUATIONS WANTED

AIRLINE catering officer, extensive knowledge aviation catering problems, requires progressive situation, thorough knowledge Europe and world routes, all types of aircraft, excellent R.A.F. references, fully mobile, free now. Box A444, care of THE AEROPLANE AND ASTRONAUTICS. 544-12

AVIATION executive, 24 years' experience all branches, current ALTP, seeks appointment with bona fide organization. Box A443, care of THE AEROPLANE AND ASTRONAUTICS. 544-x7407

AGRICULTURAL pilot, 2,000 hours crop-spraying overseas and U.K. Box A445, care of THE AEROPLANE AND ASTRONAUTICS. 545-x7409

TUITION

DENHAM LINK TRAINING CENTRE, £1 seven-day week. Denham 2161 and 3171. zzz-741

AVIGATION, LTD., provides full-time or postal tuition or a combination of these methods for M.o.A. pilot-navigator licences. Classroom instruction can be provided for A.R.D., General, certain specific types and performance schedule examinations. Link Training Dept. at Monarch 1364. For details apply Avigation, Ltd., 30 Central Chambers, Ealing Broadway, London, W.5. Phone, Ealing 8949. zzz-0719

EXETER AIRPORT, LTD., AND PLYMOUTH AIRPORT, LTD., offer the least expensive and most comprehensive flying training available today. Contract rates from £2 17s. 6d. per hour; Auster Tiger, £3 12s. 6d.; Chipmunk, £5 5s.; Messenger, £4 18s. 6d. Twin Conversion, £6 12s.; P.P.L. courses from £108 15s.; C.P.L. from £605; Instructor's course from £72 10s. Special attention to individual requirements. Full air traffic control, radio aid, VHF-DF and 24-hr. met. service. Grass or runways. Local accommodation from £3 10s.; airport, £5 15s. 6d. Exeter Airport, Ltd., Exeter 67433; Plymouth Airport, Ltd., Crownhill, Plymouth 72752. zzz-750

INSTRUMENT rating. The new July 1 procedures with VOR. D4 trainers. We are specialists, established 12 years. Phone, Knightsbridge 2089. Link Training Services, Ltd., 33 Ovington Square, London, S.W.3. 547-9018

LONDON SCHOOL AIR NAVIGATION offers full-time personal coaching with home study correspondence courses or combination of both for all aspects of professional pilot and navigator qualifications; also PPL. Officially appointed Services Courses Scheme. 33 Ovington Square, Knightsbridge, London, S.W.3. Ken 8221. zzz-755

SENIOR STRESSMAN

Starting salary between £1,400 to £1,700

Required for work on special projects associated with aircraft design and development.

Modern housing available to successful applicant.

Send full particulars, age, experience and convenient dates for interview to Box No. A446 *c/o The Aeroplane and Astronautics.*

FLYING lessons, radio, D4 Link, navigation, ground instruction, private instrument commercial training, single or twin engined planes. Maitland Drewery, Biggin Hill Airport. Phone 2277. zzz-752

SOUTHEND-ON-SEA MUNICIPAL FLYING SCHOOL, commercial and private pilots' training, night flying every night; Austers and Chipmunks from £3 15s. No entrance fee or subscription. Municipal Airport, Southend-on-Sea, Essex. Phone, Rochford 56294. 544-747

WANTED

A Serviceable Clarke tractor or similar model. Derby Aviation, Ltd., Derby Airport, Burnaston, Derby. 544-9025

CLUB NOTICES, ETC.

SURREY AND KENT FLYING CLUB, Biggin Hill (BN9) 2255. M.o.A.-approved course. Tiger and Hornet Moths, Chipmunk and Prentice. Contract rates. Route 705, one hour from Victoria. 544-0694

BOOKS AND PUBLICATIONS

THE EXPLORATION OF SPACE (First Cheap Edition), by Arthur C. Clarke. Provides answers to the many questions the intelligent layman asks about the science of "astronautics." Over 375,000 copies sold in all editions. Illustrated, 212 pages. 8s. 6d. from booksellers, or 9s. 5d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

PRINCIPLES OF HELICOPTER ENGINEERING, by Jacob Shapiro. This comprehensive review of the engineering principles governing the design and construction of helicopters provides a complete survey of present knowledge in the field. Illustrated, 448 pages, 55s. net from booksellers, or 56s. 9d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

BRITISH WIRE THREAD INSERTS

Precision made in Carbon Steel for Aluminium and Magnesium. Also in Stainless Steel and Bronze.

B.S.F.
Metric
B.S.P.
B.A.
Whitworth
Unified.

CROSS

MANUFACTURING CO. (1938) LTD.

COMBE DOWN, BATH, SOMERSET

Phone: COMBE DOWN 2355/8 *Grams:* 'CIRCLE' BATH

INDEX TO ADVERTISERS

Name	Page
A	
Adcola Products, Ltd.	16
Aero-Enterprises (Boreham Wood), Ltd.	15
Airwork, Ltd.	14
B	
Box No. A446	18
B.P. Aviation Services	10
Bristol Siddeley Engines Ltd.	12
C	
Canadair, Ltd.	5
Central Office of Information, R.A.F. Recruiting	17
Cross Manufacturing Co. (1938), Ltd.	17, 18
D	
De Havilland Aircraft Co., Ltd.	9
De Havilland Propellers, Ltd.	Inside Front Cover
Delaney Gallay, Ltd.	11
Douglas Aircraft Co., Inc.	1
E	
Eagle Aircraft Services, Ltd.	3
English Electric Co., Ltd., The, (Guided Weapons Division)	Front Cover
G	
General Electric Co., Ltd., The	14
G.Q. Parachute Co., Ltd.	8
H	
Hawker Siddeley Aviation, Ltd.	14, Back Cover
Hunting Aircraft, Ltd.	13
K	
Keegan, T. D., Ltd.	16
L	
Lockheed Precision Products, Ltd.	Inside Back Cover
M	
Marshalls Flying School, Ltd.	14
Ministry of Aviation	16, 18
Mole, Group Captain Edward	15
R	
Rochdale Metal Products	14
Rye, Claude, Bearings	17
S	
Short Bros., & Harland Ltd.	17
Standard Telephones & Cables, Ltd.	4
Symmons, Edward, & Partners	17
T	
Technivision Ltd.	17
U	
United Aircraft Export Corporation	2
V	
Vickers-Armstrongs (Aircraft), Ltd.	7
Vigors Aviation, Ltd.	15
W	
Westland Aircraft, Ltd.	6

Printed in England and Published Weekly by the Proprietors, TEMPLE PRESS LIMITED, BOWLING GREEN LANE, LONDON, E.C.1.
Registered at the G.P.O. as a Newspaper. Second class postage paid at New York, N.Y.

AGENTS ABROAD—EUROPE—Messageries Dawson (S.A.), Paris; Messageries Hachette, et Cie, Paris; W. H. Smith & Son, Paris and Brussels. CANADA—Wm. Dawson Subscription Service Ltd., Toronto; Gordon & Gotch Ltd., Toronto. U.S.A.—Eastern News Co., 306 West 11th Street, New York, 14, N.Y. AFRICA—Central News Agency, Ltd., Cape Town; W. Dawson & Son (S.A.), Cape Town. ASIA—W. Thacker & Co., Ltd., P.O. 190 Bombay. AUSTRALIA and NEW ZEALAND—Gordon & Gotch (A'sia), Ltd.

ON THE GROUND

Longer, trouble-free periods between overhauls. Less wear of vital parts, less time spent in maintenance.

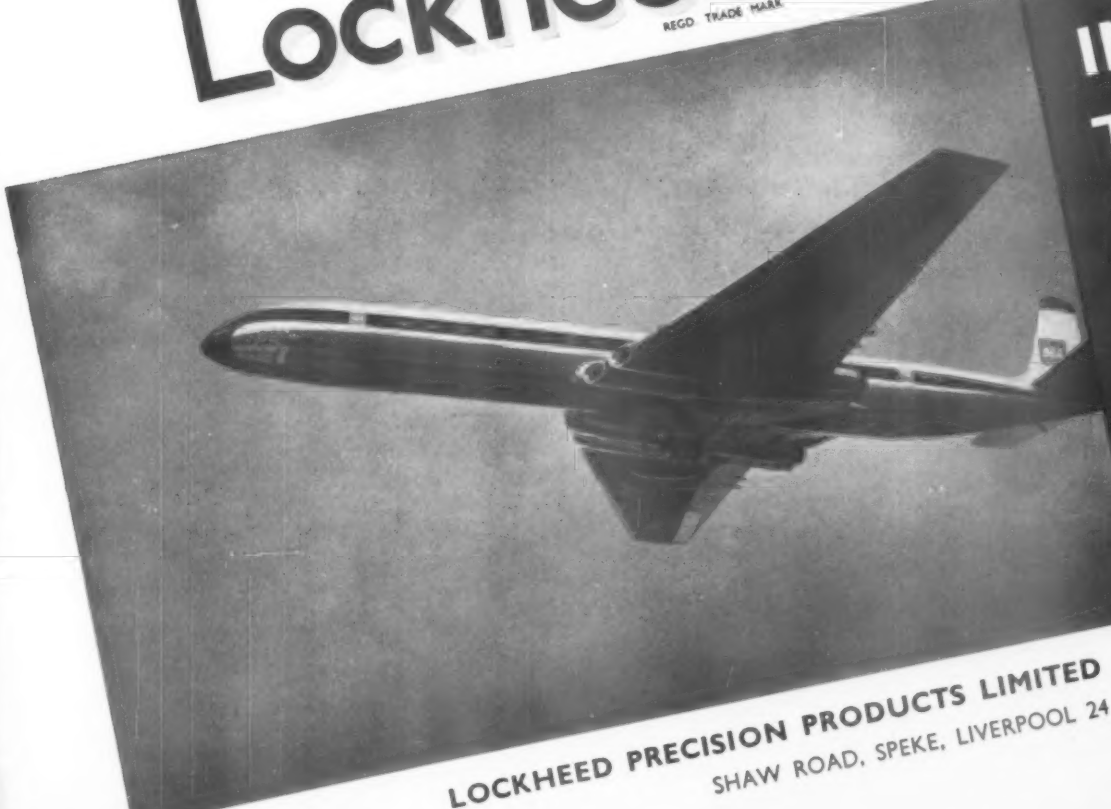
Photograph by courtesy of The de Havilland Aircraft Company Ltd.

ALL-BRITISH

Lockheed

REGD TRADE MARK

AIRCRAFT EQUIPMENT

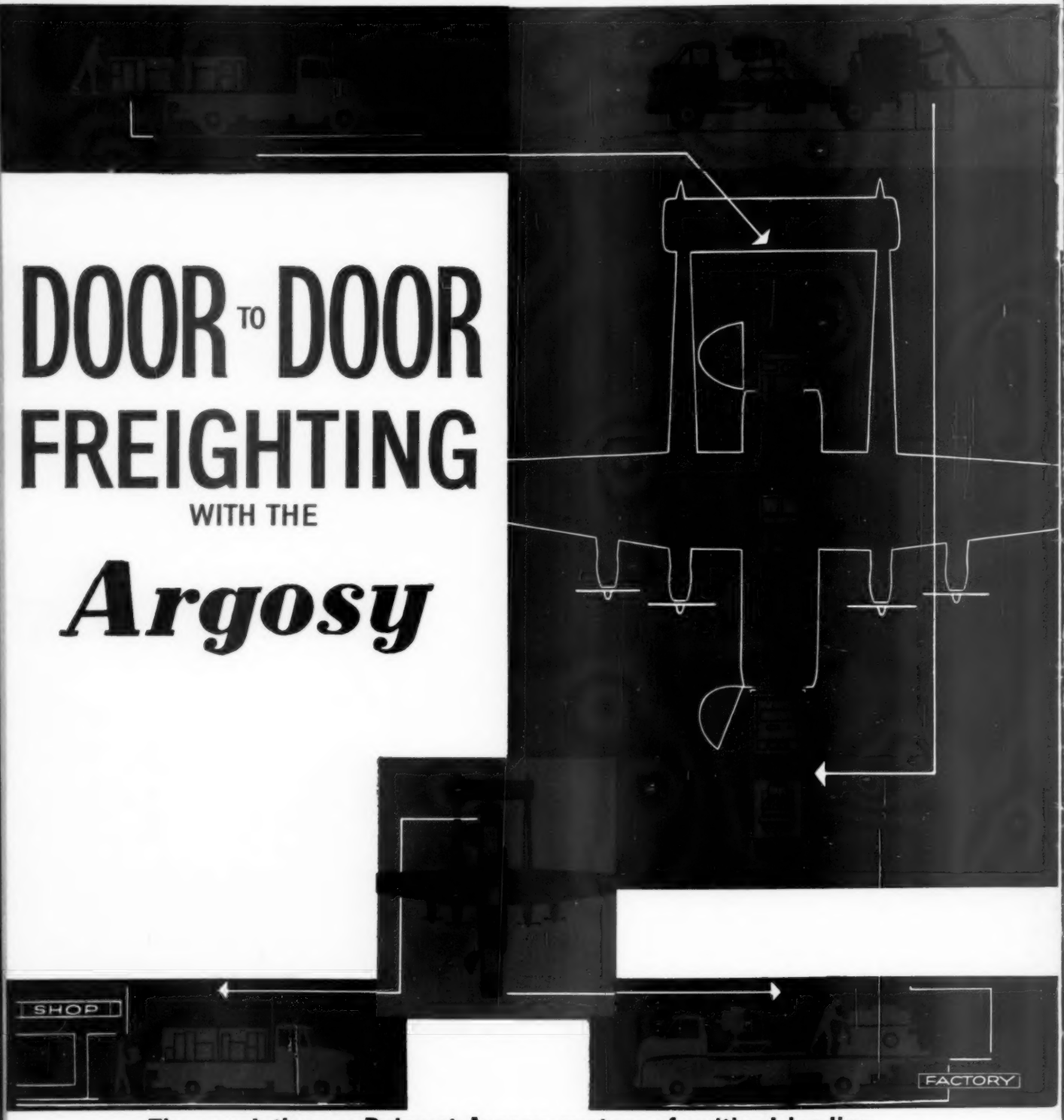


IN THE AIR

LOCKHEED PRECISION PRODUCTS LIMITED
SHAW ROAD, SPEKE, LIVERPOOL 24

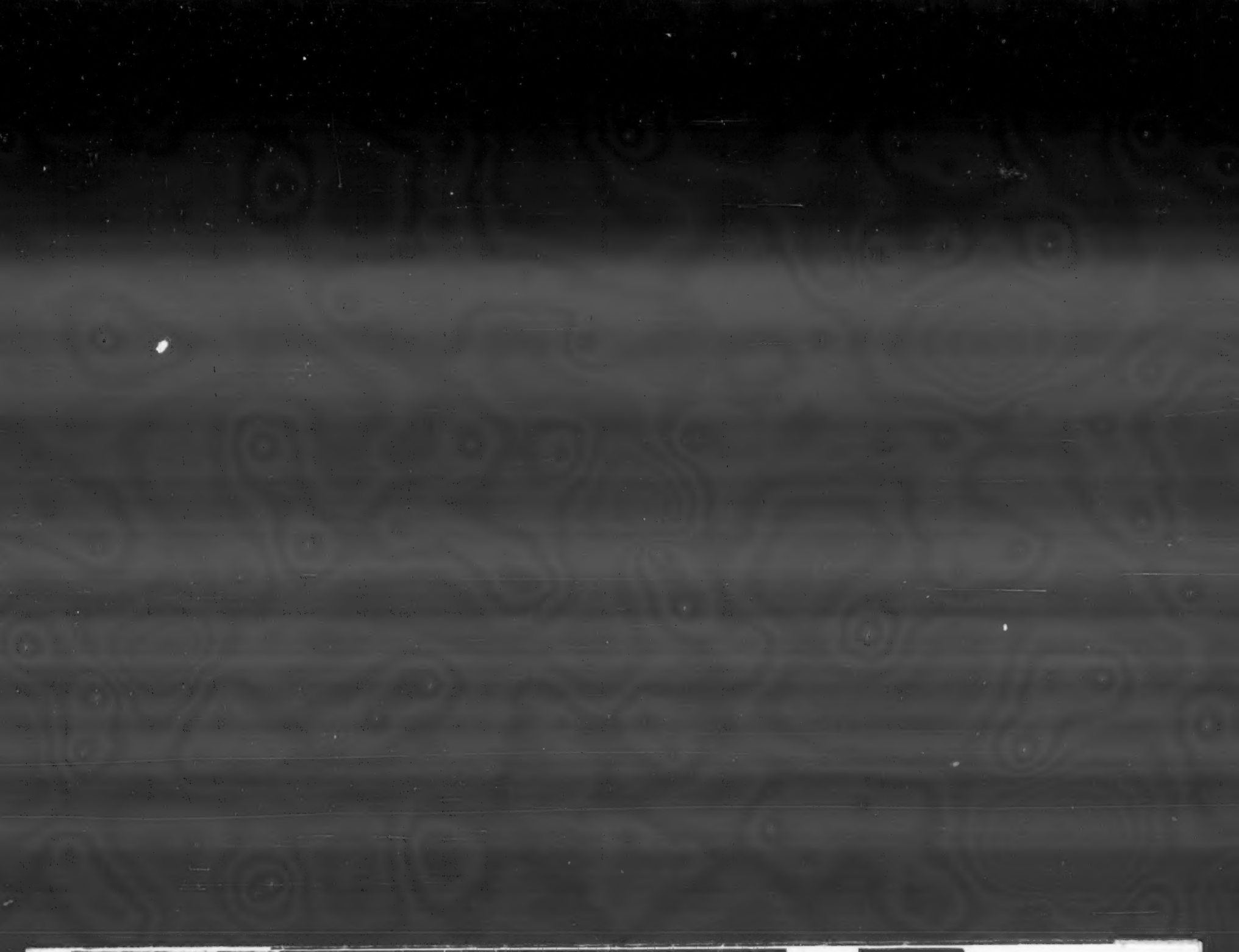
ONE OF THE AUTOMOTIVE PRODUCTS GROUP

DOOR TO DOOR FREIGHTING WITH THE *Argosy*



The revolutionary Rolamat-Argosy system of unitized loading

One pallet, one waybill — one streamlined operation door to door. That's the revolutionary air freighting system with the Rolamat-equipped Argosy. Small parcels are built up on the pallet, the unitized load rolled onto a truck and straight from the truck into the Argosy. Pallets can be linked together to take heavy bulky freight, such as machinery. No packaging is needed. Loads up to 13½ tons, less than 6 ft. 8 ins. high and 8 ft. 8 ins. wide, can be slid easily into the Argosy's 47 ft. long freighthold. A complete turnround at the airport takes only 20 minutes, including refuelling. Off-loading is just as easy. The cargo is rolled onto the lorries backed up at both ends of the fuselage. No special handling is required — no need for lifting trucks or cranes. Rolamat saves time, saves trouble, saves money, saves labour, saves warehouse space. Yes sir, things really *move* with the Rolamat-Argosy system of unitized freight handling!

Designed to bring the cost of air freight down to earth

HAWKER SIDDELEY AVIATION *32 Duke Street, St. James's, London, S.W.1.*